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The Maritime Employment Impact of the Port of Gulfport, Mississippi

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The U.S. port system is an essential component of the national transportation and defense system. Ports are also significant contributors to the national economy and act as economic catalysts in the areas in which they are located. Ports generate jobs, income, revenue, and taxes. At the request of the Mississippi Development Authority, the Stennis Institute of Government and Community Development at Mississippi State University conducted this study to examine the impact of the revitalization of the Port of Gulfport on employment in the maritime industry. The purpose of this study is to:

- Profile the economic activity of the Port of Gulfport and the Mississippi State Port Authority
- Evaluate the economic impact of the Port of Gulfport on direct maritime industry employment in the local area
- Model the economic output and induced or multiplier effects associated with maritime industry employment
- To specifically identify the direct maritime employment that is related to the revitalization of the Port of Gulfport

The study team at the Stennis Institute used a combination of port/shipper interviews, site visits, analysis of commodity flow data, and economic modeling to accomplish the objectives of the study. The study team collected extensive secondary data and conducted an extensive review of existing maritime and port industry literature. The team collected primary data to include surveys, face-to-face interviews and telephone interviews with stakeholders to validate primary and secondary data and to fill data and information gaps.

The port industry does not exist in isolation and is part of a global transportation network, this report contains an overview of the maritime shipping industry to provide a contextual understanding of the environment within which the port industry operates. The port industry is concerned with the movement of cargo through a port including those services that enable cargo to be moved from its point of origin to a vessel or from a vessel to its destination; employment related to these activities is considered direct employment because these jobs would not exist but for the existence of the port. Those services include container services, terminal operators, storage and warehouse services, wharfage and drayage operations, freight forwarders, stevedoring firms, longshoreman, chandlers, export packing operations, crew services, inland transportation (railways, trucking firms, pipeline, and barges), equipment rental services, suppliers of bunkers, minor ship/boat repair services, navigational services, custom house brokers, governmental agencies, banking and insurance services, and other professional services that are directly required to move goods through a port. When examining the employment impact of a port, port users must also be considered, these are industries that are dependent on the port in the sense that the ports' existence is a major factor in the firm's location decision.; employment in these industries is considered to be indirect or induced.

This study found that economic activity related to the maritime industry at the Port of Gulfport supports a total of approximately 2,464.5 full-time equivalent jobs with labor income of approximately $99,981,494 within Harrison, Hancock and Jackson counties; of these 1,121.6 were direct full-time equivalent jobs with associated labor income estimated to be $45.07 million. Maritime services activities at the Port of Gulfport supported 903.6 direct full-time equivalent jobs and maritime manufacturing and fabrication industries employed 218.0 full-time equivalent workers within the three

counties of Harrison, Hancock, and Jackson. The total economic output related to maritime services employment and maritime industry manufacturing and fabrication employment at the Port of Gulfport is approximately $425.5 million annually.

The study team's literature review of 38 studies that examined the economic impact of ports across the United States supports the assumption that the job creation estimates of the employment impact of the Port of Gulfport contained within this study may be extremely conservative. The finding that induced and indirect job creation associated with port activities exceeds the direct maritime job creation is unsurprising because the economic benefits of ports are more related to the dynamics of the supply chains that they serve. This reality is challenging because the direct economic benefits of ports can be more easily quantified whereas indirect and induced effects are more complex to assess and extend across wide geographic areas.

The construction phase of the revitalization of the Port of Gulfport was completed in December of 2018; the port is now positioned to maximize investments made in newly created infrastructure, cargo handling equipment, and increased capacity. Findings of this study indicate that the capital investments made to revitalize and to increase the capacity of the Port of Gulfport are beginning to enable the port to realize its potential. For example:

- In 2017, the Port of Gulfport was added to the U.S. Department of Transportation's list of the 25 most active ports in the United States based upon TEU throughput.
- Over the period from 2016 to 2017, the U.S. Department of Transportation Statistics reported that container volume at the Port of Gulfport increased by 24.5 percent and dry bulk shipments increased by 40.5 percent.
- From 2014 to 2018 there was a 67.5 percent increase in full-time equivalent employment of members of the International Longshoremen's Association.

Many forecasts project that seaborne trade volume will grow at a compound annual rate of 3.8 percent over the period from 2018 to 2023 and that containerized shipping and dry bulk commodities are projected to experience the fastest rate of growth. Investments made to revitalize the Port of Gulfport, including: the expansion of the size of the port to encompass 300 acres, the dredging of the channel to its 36-foot authorized depth, and the installation of three ship-to-shore gantry cranes have been recently completed. As a diversified polyfunctional port with the capacity to handle a vast array of containers, bulk cargo, and/or raw materials, the Port of Gulfport appears to be well-positioned to capture projected increases in seaborne trade volume. The maritime service providers, stevedore and terminal operators located at the Port of Gulfport, including Ports America, SSA Marine, and Crowley Maritime Corporation have extensive experience, capabilities, and the capacity to provide a broad array of domestic and international transportation and logistics services that will support the future growth and expansion of the Port of Gulfport.

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III. Overview of the Maritime Shipping Industry

The Port of Gulfport operates within the context of the larger maritime shipping industry. The maritime shipping industry consists of anything related to ships, the navigation of ships from point A to point B, seafarers, ship owning and related vessels that are in the maritime shipping business. The maritime shipping business is the act of the carriage of cargo from point A to point B using ships which fall under the umbrella of the Maritime industry. The Maritime industry includes the companies and workers involved in getting cargo that uses the maritime shipping industry from a point of production to a receiver's warehouse; this encompasses: transportation (ship, rail, truck, barge, and other service vessels), stevedoring companies, longshoremen and labor unions, chandlers, freight forwarders and customs brokers, maritime logistics providers, importers and exporters, shipbuilding and maintenance companies, warehouses and port facilities. The world commercial shipping fleet consists of approximately 94,171 vessels with a combined tonnage of 1.91 billion deadweight. It is estimated that seaborne trade accounts for 90 percent of total world trade by volume. The United Nations Conference on Trade and Development (UNCTAD) forecasts that seaborne trade volume will grow at a compound annual growth rate of 3.8 percent over the period from 2018 to 2023 with containerized shipping and dry bulk commodities projected to experience the fastest rate of growth.[1]

Table 1: Seaborne Trade Forecasts – Percentage Change

Source	Annual Growth Rate	Period	Trade Segment
UNCTAD*	3.8	2018 to 2023	Seaborne Trade
	4.9		Dry Bulk
	6.0		Containerized
	1.7		Crude Oil
	2.6		Refined Petroleum Products and Gas
Lloyd's List Intelligence**	3.1	2017 to 2026	Seaborne Trade
	3.6		Dry Bulk
	4.6		Containerized
	2.5		Liquid Bulk

Source:
** United Nations Review of Maritime Transport 2018*
*** Lloyds List Intelligence Research 2017*

Cargo is carried by various types of ships across the world. Maritime shipping can be segmented into two primary sub-markets – Liquid Cargo/Wet Bulk and Dry Cargo. Wet Bulk accounts for approximately 29.8 percent of global trade and Dry Cargo accounts for about 70.2 percent of global trade. Dry Cargo is comprised of Dry Bulk and Containerized Cargo/Break Bulk. Dry Bulk consists of commodities that are carried in loose or unpacked form to include iron ore, coal, grain, timber or forest products, seed and fertilizer; bulk cargoes are normally loaded at dedicated terminals. Break Bulk is cargo that is carried in a unitized form, it may be bagged, drummed, bundled, crated, boxed or it may be non-unitized general cargo such as vehicles, machinery, or steel. Containerized cargo includes a variety of goods (manufactured consumer goods) packaged in smaller transportation units – these goods are labelled as general cargo and shipped on liners, predominantly in containers. The most common form of shipment is via containership and roll-on/roll-off ship (RoRo). With an estimated value of $12 trillion U.S. dollars in 2017, cargo transported by the container shipping industry is estimated to represent 60 percent of

[1] https://unctad.org/en/pages/PublicationWebflyer.aspx?publicationid=2245. Accessed March 2019.

the world's seaborne trade by value. Over the period from 1980 to 2017, the quantity of goods shipped by container increased from approximately 102 million metric tons to 1.83 billion metric tons.

Special ships have been designed and built for different types of freight. Ships that carry bulk cargo are known as bulk carriers, ore carriers, or bulkers; these ships are classified based on their deadweight and freight rates are generally charged based upon metric ton depending upon the type of bulk cargo. Break Bulk ships come in a variety of sizes that range between 2,000 deadweight to 40,000 deadweight, freight rates for Break Bulk cargo is determined based on freight ton or revenue ton meaning that freight may be charged on volume or weight. Ships may be geared or gearless, geared ships carry their own loading equipment (e.g. cranes); gearless ships do not. Modern container ships are predominantly gearless; in 2017, geared ships accounted for only 4.2 percent of total TEU container ship deliveries. Examples of ships designed and built for different types of freight include:

- tankers for crude oil, petroleum products, chemicals, liquid gas and fruit juice concentrate
- Bulk carriers for bulk goods and commodities such as ores, coal, and grain
- Refrigerated vessels (reefers) for fruit
- Container ships which increasingly take on the task of general cargo ships on long-haul routes
- Roll-on/roll-off (Ro/Ro) ships for shipping trucks and vehicles.

Types of ships include:

- Oil Tankers
- Dry Bulk Carriers
- General Cargo Carriers
- Container Carriers
- Gas Carriers
- Chemical Tankers
- Offshore Vessels
- Ro/Ro ships
- Ferries and Passenger ships
- Other types of ships

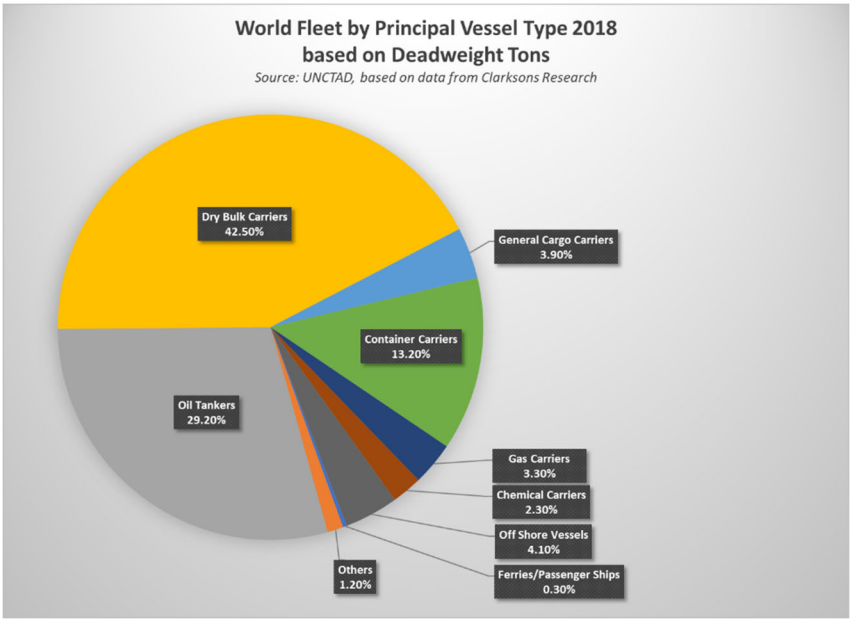


Figure 1: World Fleet by Vessel Type 2018

Liner Services

These ships are operated by shipping lines; ships may be owned by the shipping lines that operate them and/or may be chartered by the shipping lines from the ship owners. Shipping lines may operate as a liner service or as a tramp service. Liner service is the service of transporting goods via ocean-going ships that transit regular routes on fixed schedules (mostly weekly) of call at advertised ports. A tramp service is a ship that has no fixed routing, schedule, or itinerary; these services may load cargo from any port and deliver it to any other port. Liner services normally publish their schedule and their rates; tramp services do not. Tramp carriers are more likely to be designed to carry homogeneous bulk cargo. Most liner ships are containerships or Ro/Ro ships. There are approximately 500 liner shipping companies in operation worldwide with an estimated 8,163 ships with total TEU capacity of 25,290,013; of these, approximately 5,144 ships are

containers ships with TEU capacity of 20,804,471 and approximately 1,200 vessels are Ro/Ro or car carrier ships. Many containers ships have the capacity to transport up to 8,000 containers of goods and some car carrier ships handle as many as 7,600 cars.

Image 1: Containerized Shipments

The term used to calculate capacity and volume in the containerized shipping industry is the Twenty-foot Equivalent Unit (TEU); it is based upon the most common container length of 20 feet which is the lowest common denominator for container lengths. The most common dimensions for a 20-foot container are 20 feet long, 8 feet wide, and 8 feet 6 inches high with a volume of 1,360 cubic feet; this container size is defined as one (1) TEU. Another common container size is 40-foot in length, 8 feet wide, and 8 feet 6 inches high; this container size has a volume of 2,377 cubic feet and is equivalent to two (2) TEU. In addition to the standard dry cargo container (general purpose), containers come in multiple sizes to include ten-foot, twenty-foot, forty-foot, and forty-five-foot. *Special* containers are used to ship *out of gauge* (OOG) cargo, this is cargo that extends over and above the standard measurement of a *general-purpose* container. OOG cargo may be carried in open top, open end, platforms, or flat racks; there are also refrigerated containers (reefers) and liquid bulk (tank) containers that are built to the same lengths and widths as *general-purpose* containers. Standardized containers are designed and built so that containers may be efficiently moved and stacked by cranes and to facilitate intermodal freight transport — moving via ship, barge, rail, or truck without unloading and reloading cargo. The International Organization for Standardization (ISO) sets standard sizes for all containers across the world. In 2018, the world container ship fleet had a capacity of around 246 million metric tons deadweight tons and containers within the global fleet carry the equivalent of 34 million TEU. In 2017, the global volume of world containerized trade was 148 million TEU.

Maritime transportation is derived demand that supports global and domestic trade, business, and commerce. Growth in world trade drives growth in the maritime shipping industry. Global trade is characterized by intense competition between shipping lines and between ports; the maritime industry is high risk and capital intensive. The industry operates within a constantly changing world economic landscape that requires continuous investment in improvement, innovation, and efficiency. The global recession of 2008 – 2009 is illustrative of the changing environment and risk faced by the maritime transportation industry. Over the period from 1995 through 2008, world container throughput exhibited an average annual compound growth rate of 10.5 percent. Growth in world trade and climbing freight rates led the shipping industry to over-invest in capacity in response to increased demand, ordering new mega-ships that expanded fleet capacity. For example, the Ocean Alliance received delivery of 108 ultra-large container vessels (ULCV) in excess of 14,000 TEU; this doubled the number ULCVs deployed. These investments in new and larger ships led to overcapacity that drove down shipping rates, eroded profitability, and generated significant losses within the industry. The

global recession and the financial crisis of 2009 – 2010 had a significant negative impact on world trade flows. World trade declined by 14 percent in 2009 due to the global recession and world container flows dropped by 49 million TEU between 2008 and 2009; although growth in container throughput resumed growth subsequent to 2009, the annual compound rate of growth in container throughput slowed over the period from 2009 through 2017. Overcapacity caused freight rates to fall dramatically, and at the beginning of 2009 about 9 percent of bulk carriers lay idle worldwide. Shipping rates reached record lows in 2016. The severity of this overcapacity led to the collapse of Hanjin Shipping in August of 2016; at the time Hanjin was the world's seventh largest container line. Sluggish economic growth and overcapacity continued to impact the industry throughout 2016 and 2017. In 2017, the economic outlook for global seaborne trade improved in tandem with an upswing in the world economy. 2017 was a peak season for ocean carriers with record volume at many ports, particularly in the United States; although shipping rates remained low due to excess capacity, they improved when compared to 2016. The United Nations Conference on Trade and Development (UNCTAD) reported that containerized shipping expanded by 4 percent in 2018, this was the highest rate of growth in five years.

In response to the slowdown in global economic growth and overcapacity, large companies bought smaller companies and large oceanic carriers formed alliances to minimize the negative impacts of significant changes in demand and freight rates. The formation of these alliances and related global vessel-sharing agreements created market dominance in the ocean freight market. Three major new alliances that formed in 2017 were:

1) The Ocean Alliance which consisted of CMA CGM; OOCL; COSCO; and Evergreen;
2) The 2M+H alliance consisting of Maersk, MSC, and Hyundai Merchant Marine; and
3) the Transport High Efficiency Alliance (THE) consisting of Hapag-Lloyd; Mitsui O.S.K. Lines, Ltd. (MOL); Kawasaki Kisen Kaisha, Ltd. (K Line); Nippon Yusen Kabushiki Kaisha (NYK); and Yang Ming.

These three alliances included the five leading global fleet operators (see Table 2 page 11); all of the top five global fleet operators are either private- or family-owned businesses, with the exception of COSCO which is owned by the Chinese government. Since the formation of these alliances, at least one member of each alliance has moved to add capacity to their operations. Maersk acquired Hamburg Sud; Hapag-Lloyd's acquired UASC; and COSCO acquired OOIL; in 2016, COSCO merged with China Shipping Container Line (CSCL), at the time CSCL was the 12th largest shipping carrier in the world. In 2018, the partners in these three alliances accounted for approximately 80 percent of the container trade in the world and almost 90 percent of container volume on the primary trade lanes of the world. These acquisitions have added capacity, equipment, infrastructure, and expanded market access for all three shipping lines and increased the industry influence of the alliances to which they belong. Less competition has allowed for the lowering of operating costs, better management of ship capacity, expanded reach that allows alliance partners to service new routes and new ports, and permitted better coordination in forecasting demand and increasing capacity. The absence of competition, with five or six carriers controlling a majority share of international shipping, has the potential to create oligopolistic economic structures; increase the power of large players, particularly their bargaining power with ports; and may lead to decreased service quality to include: ship bunching and increased congestion at terminals, delays in the spotting and release of intermodal trains, and may result in chassis dislocations that will transfer the cost of dislocation fees to shippers and importers.

Global containership fleet ownership is controlled by shipping companies in only a relative few countries and by a relatively few shipping liner service companies. Approximately 72 percent of the world's total TEU is controlled by 12 companies (Table 2 below). In 2017, an estimated 752.7 million TEUs of

Table 2: Global Containership Fleet by Shipping Company Country of Ownership, Ranked by Deployed TEUs in 2018

Rank	Ocean Carrier	Country	Number of Ships	TEU Deployed in 2018	Market Share
#1	A.P. Moller-Maersk	Denmark	703	3,879,439	15.3%
#2	Mediterranean Shipping Co. (MSC)	Switzerland	519	3,118,108	12.3%
#3	CMA CGM	France	476	2,554,264	10.1%
#4	China Open Shipping Company (COSCO)	China	459	1,972,491	7.8%
#5	Hapag-Lloyd	Germany	235	1,550,874	6.1%
#6	Ocean Network Express (ONE)	Japan	228	1,536,312	6.1%
#7	Evergreen Line	Taiwan	201	1,110,708	4.4%
#8	Orient Overseas Container Line (OOCL)	China	99	689,986	2.7%
#9	Yang Ming Marine Transport Co.	Taiwan	100	609,749	2.4%
#10	Pacific International Line (PIL)	Singapore	132	413,334	1.6%
#11	ZIM Integrated Shipping Services	Israel	83	398,926	1.6%
#12	Hyundai Merchant Marine	South Korea	72	382,144	1.5%

Source: UNCTAD Secretariat Calculations based on data from MDS Transmodal

containers were handled in ports worldwide; of this amount, 28.4 percent of world container throughput occurred in China (213.7 million TEU) and 6.8 percent of world container throughput took place in the United States – container port throughput in the U.S. was 51,425,466 TEUs in 2017.[2] 2018 and 2019 were years of mergers in the shipping industry and additional capacity is anticipated to enter the market in 2019. *Logistics News* and *Drewry World Maritime News* project that global container throughput will be over 800 million TEU in 2019 with associated EBITDA in excess of $25 billion (US);[3] however, the industry is faced with a high degree of uncertainty due to multiple macroeconomic factors including the impact of Brexit and the U.S.— China trade relationship. These factors may lead to a softening of demand in the global container industry and dampen industry growth rates. Other trends that impact the industry, include:

- **Larger Ships and Industry Consolidation.** Ultra-Large container vessels are classified as having a carrying capacity greater than 14,000 TEU. According to Alphaliner data, the containership orderbook has 345 orders for new ships with a total capacity of 2.67 million TEU; most of this increased capacity is for larger vessels. COSCO has ordered 28 new ships with an average capacity of 17,700 TEU per vessel; this would increase COSCO's capacity 27.6 percent or 496,000 TEU. The French shipping company CMA CGM has ordered nine 22,000 TEU containerships that are anticipated to come online in 2019. In February 2019, Ocean Network Express (ONE) set a record for the largest amount of cargo stowed on a containership by carrying over 19,100 TEU of

[2] United Nations Conference on Trade and Development, Review of Maritime Transport 2018, Publication UNCTAD/RMT/2018
[3] https://steelguru.com/logistic/what-does-2019-hold-for-the-container-port-industry/533390. Accessed February 15, 2019.

containers.[4] As the industry consolidates, smaller operators that do not serve specific niche markets may be forced out of the industry. The impact of increasing consolidation may lead to fewer choices of carriers, less competition, and large alliances may be able to influence market prices and shipping rates.

- **Increased adoption of automated technologies.** As vessel sizes increase so do the complexities of effective and safe stowage and cargo load optimization; the industry is increasingly dependent upon computerized technologies to meet these needs. Due to the standardization of containerized shipments, port terminals have become increasingly automated; as of 2018, approximately 8.8 percent of all container terminals have become fully or partially automated. With the advent of the increase in the size of ships, ports are under increasing pressure to improve their throughput and ship turnaround time. The primary container port functions that are subject to automation include: yard management; automated gates; automated tracking and tracing of ships, cranes, containers, and yard equipment; automated yard cranes that are able to store and retrieve containers in stacking areas; automated horizontal transport; and automated quay cranes. Ports in Europe and Asia have adopted automated technologies at a faster pace than have ports in the United States. The process of automating seaports requires a significant capital investment and the need to implement a continuum of digital technologies, software platforms, and robotic hardware. For example, the automated systems and upgrades at the Port of Long Beach cost in excess of $1.3 billion and required over two years to implement. High costs, uncertain return on investment, and pushback from labor groups has acted as an obstacle to the diffusion and adoption of automated technologies at smaller terminals placing them at a competitive disadvantage with larger terminals.

- **Vertical and horizontal integration within the supply chain.** Terminal operators and port authorities are seeking to expand their activities beyond the port gate into the wider supply chain, these activities include: diversification of revenue sources and maintaining pace with trends in digitization, smart ports, automation, and blockchain technologies to optimize processes. Technological advances in the shipping industry also includes the development of autonomous ships, drones, and blockchain technologies. Technological advances applicable to ports and terminals create opportunities to improve efficiency and productivity, and to increase safety and security. However, uncertainty exists about the full acceptance of these technologies due to concerns regarding the safety, security and cybersecurity of these technologies. Blockchain technology initiatives provide opportunities for applications to record information on ships, track cargo, automate paper filings and documentation, and provide end-to-end supply chain visibility. The lack of interoperability between systems and shared platforms presents a challenge in the industry as some carriers are developing their own systems that lack interoperability. In August 2018, Maersk, in cooperation with IBM, announced a blockchain based global trade digitization program (TradeLens©). TradeLens© is designed to connect multiple international trade stakeholders (exporters, freight forwarders, ports and terminals, ocean carriers, in-land transporters and truckers, and importers/shipment consignees) to introduce efficiencies into the filing, verification, processing and coordination costs related to cross-border transportation. In addition to Maersk's blockchain digitization program, CMA CGM, COSCO, Evergreen, OOCL, and Yang Ming have developed a consortium to develop the Global Shipping Business Network that uses an open digital

[4] https://www.marinelog.com/news/one-sets-new-containership-stowage-record-19100-teu/. Accessed February 14, 2019.

platform based on distributed ledger technology. At the same time, ZIM Lines is working with third parties to develop its own blockchain technologies.

- **Increased Regulation.** The International Maritime Organization (IMO) is an agency of the United Nations. Headquartered in the United Kingdom, the IMO is comprised of approximately 174-member states and three associate members. The mission of the IMO is to "*promote safe, secure, environmentally sound, efficient, and sustainable shipping through cooperation*."[5] The vision of the IMO is to "*uphold its leadership role as the global regulator of shipping, promote greater recognition of the sector's importance and enable the advancement of shipping, while addressing the challenges of continuing developments in technology and world trade and the need to meet the 2030 Agenda for Sustainable Development*."[6] The IMO consists of six main bodies responsible for the adoption and implementation of conventions and protocols. Conventions must be ratified, accepted, approved or acceded to by member states. There are more than 50 international conventions and more than 1,000 codes under the oversight of IMO, as well as multiple protocols and amendments to conventions. The primary IMO conventions include:

    - International Convention for the Safety of Life at Sea (SOLAS), 1974 as amended.
    - International Convention for the Prevention of Pollution from Ships (MARPOL), 1973, as modified.
    - International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), as amended.

  Amendments to the International Convention for the Prevention of Pollution from Ships (MARPOL) will have a significant yet to be determined impact on the maritime shipping industry. Amendments to MARPOL adopted in 2008 are currently being implemented. In 2016, the IMO approved a mandatory requirement for ships to record and report their fuel consumption; this reporting requirement became effective on January 1, 2019. The data collection process is the initial step in a process to enable further decisions regarding measures that may need to be adopted to enhance energy efficiency and reduce greenhouse gas emissions associated with maritime shipping. In 2018, the IMO adopted regulations that would achieve the goal to reduce ocean-carrier emissions by 50 percent by 2050 as compared to 2008 levels. Additional regulatory changes by the International Maritime Organization (IMO) require that all fuel oil used by ships will need to have a sulfur content of no greater than 0.50 percent mass/mass and be in compliance with this regulation as of January 1, 2020. IMO's regulatory guidelines for compliance state that ships taking on fuel oil must obtain a bunker delivery certification that states the Sulphur content of the fuel oil supplied and ships must be issued an International Air Pollution Prevention Certificate (IAPP) by their flag states. Compliance will be determined by the flag states and or the country/state where ports are located. To meet the requirements, ships can use low-Sulphur marine fuels, alternative fuels (e.g. liquified natural gas or methanol), fuel oil or exhaust gas cleaning systems (scrubbers) which clean the emission before they are released; however, some shipping lines may opt to use non-compliant fuels because the IMO does not have the authority to enforce its regulations. There is a great amount of uncertainty regarding the impact of this regulation on shipping costs and industry profitability; for example, Goldman Sachs estimates a total cost of $240 billion, but Wood Mackenzie expects the cost of compliance to $60 billion to the maritime industry. Because fuel costs represent as much as 50 to 60 percent of total ship operating costs depending upon the type of ship, increases in fuel costs will

[5] International Maritime Organization http://www.imo.org/en/About/strategy/Pages/default.aspx. Accessed January 2019.
[6] Ibid.

undoubtedly result in changes to the terms of shipping contracts, changes in the structure of fuel surcharges, the potential slowing down of some vessels, and the demolition of fuel-inefficient vessels; it may also result in further consolidation of the industry as smaller local or regional shipping companies face increased costs and surcharges that they may be unable to pass on to their customers.

Maersk Oil Trading (MOT) is positioning itself to become a significant player in the supply of IMO2020 compliant bunker fuel. MOT supplies bunker fuel to A.P. Moller-Maersk's vessels and to third-party customers. From 2017 to 2018, MOT jumped from being the 27th largest supplier of bunker at the Port Authority of Singapore to become the 9th largest supplier; Singapore is the world's biggest bunkering port. In February 2019, A.P. Moller-Maersk announced an agreement with PBF Logistics LP to produce and supply 0.50% sulfur bunkers on the U.S. East Coast. Under this agreement, PBF will process Maersk crude at its terminal facility in New Jersey, with Maersk Oil Trading then selling the IMO 2020 compliant bunker fuel to other shipping lines. MOT is also investing in high capacity bunkering mass flow equipment that is capable of delivery rates of 1,000 million tons of bunker fuel per hour; this equipment is designed to significantly enhance the efficiency of fuel delivery to vessels and reduce the time of port stays.

Port Operations

A nation's economic vitality and competitiveness is linked to its ability to ship raw materials, intermediate goods, and final products efficiently and economically, and to receive these goods in productive, efficient, and cost-effective ports. Approximately 80 percent of international trade is channeled through ports. The port industry is a subsector of the maritime industry. The major function of a port is to supply services to ships (piers, refueling, repairs, etc.) and to supply services to freight (warehousing, transshipment, etc.). It is misleading to consider a port strictly as a maritime terminal since it acts concurrently as a land terminal where inland traffic originates and ends. Ports engage in a range of cargo related activities and in production and distribution activities.

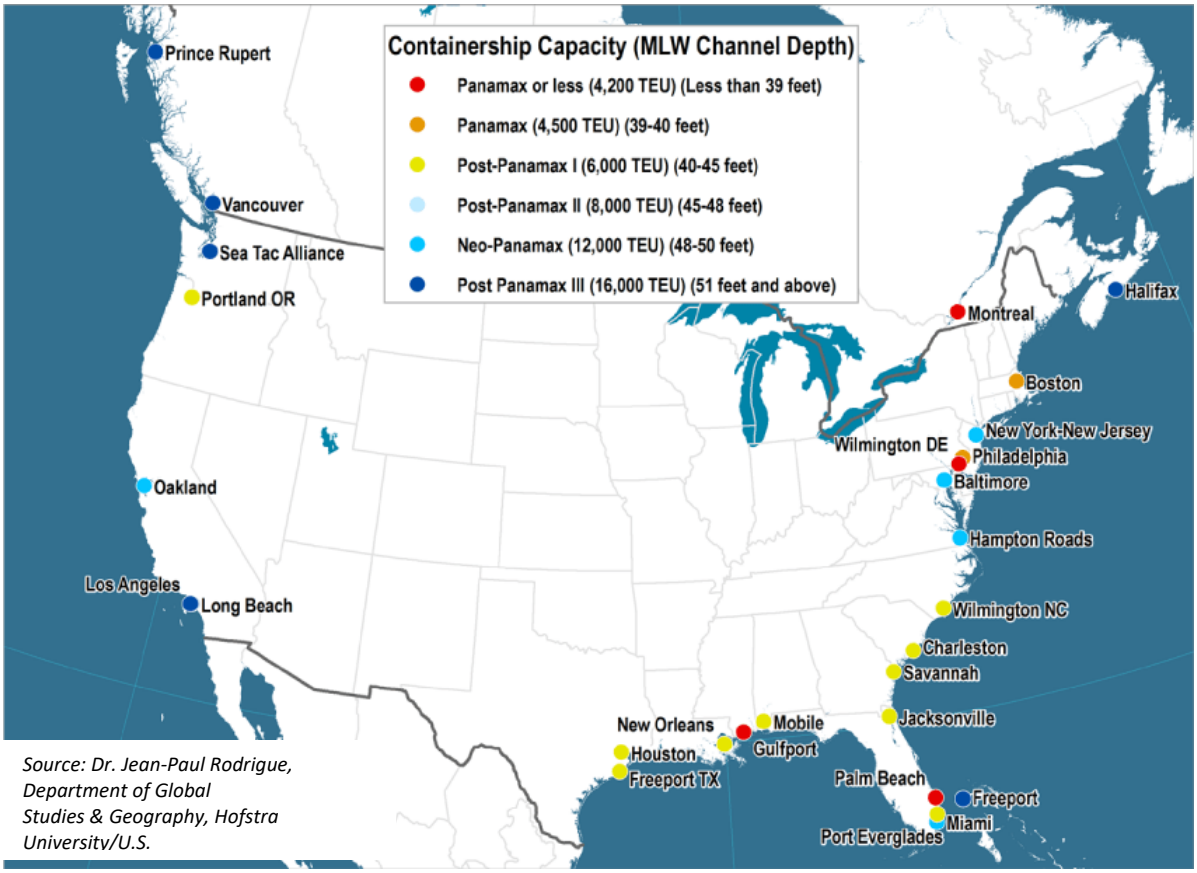
- Port cargo functions are related to the handling of cargo: unloading, loading, and storing cargo waiting to be picked up or transshipped. These activities usually occur within the terminal facility. The de-stuffing (unpacking of containers) and/or palletization of container loads may take place at the port or at specialized facilities within proximity to the port. Transloading is associated with de-stuffing activities when maritime containers are transferred to domestic containers.[7] Empty containers are also stored and then are available for pick up for stuffing and subsequently exported.
- Port related production and distribution includes a range of activities that transforms cargo to be imported or exported through the port. Inbound cargo may require consolidation and sorting for distribution to inland customers. Outbound cargo may be warehoused to await loading (Break Bulk cargo) or to be stuffed (packed into containers). Many production (manufacturing) activities that are related to global markets for inputs or outputs tend to be located within the vicinity of ports.

[7] Maritime shipping companies prefer to keep their containers within their network; at major import gateways there is a preference to transload maritime containers (predominantly 40-foot containers) into domestic containers (predominantly 53-foot containers). From a transportation perspective, this allows the contents of three maritime containers to be transshipped into two domestic containers. Also, domestic containers tend to have less structural integrity and many cannot be forwarded via ships. Transshipping activities have led to the creation of container stuffing facilities in proximity to major ports – commodities are brought into these facilities using bulk transportation (truck or rail) and stuffed into empty maritime containers and vice versa.

- In addition to significant cargo functions, many ports are also involved in other activities such as fishing, ferries, cruises, and recreational activities (marinas).

The shift from conventional break-bulk terminals to container terminals has changed the fundamental design and layout of ports and terminals; containerization has changed the land area requirements of ports and the infrastructure and equipment that is necessary to successfully compete in the industry. Historically, conventional break-bulk terminals focused on *direct transshipment* from maritime vessels to inland transportation modes (e.g. rail or truck) or vice-versa. *Direct transshipment* required relatively short dwell times for cargo to remain in terminals waiting to be loaded or unloaded but required ships to remain in berth for multiple days as they were being loaded or unloaded; therefore, direct transshipment required less temporary storage area in terminals. The shift to containerization, required ports to increase their land footprint and to make significant capital investments in land, infrastructure, and equipment. These investments include expansion of stacking yard services by gantry cranes and vehicles and other equipment used to move containers around the terminal. In many cases, ports have invested in infrastructure to handle refrigerated containers with special stacking areas and terminals.

Ports are constrained by the quality of maritime access they can provide; a primary component of access is the depth of port access channels. Other limiting factors include: berth space, turning basins, equipment (cranes), and yard space. Channel depth limits the types of vessels that are able to call at the port. A typical Panamax ship of 65,000 deadweight tons requires more than 40 feet of channel depth; post-Panamax containerships require a channel depth of 40 feet or greater, the number of these ports is



Map 1: Containership Capacity based on Mean Low Water (MLW) Channel Depth at Major U.S. Ports

limited. In the United States, the U.S. Army Corps of Engineers is tasked with constructing and maintaining navigation channels. There are three different measures of channel depth: 1) the depth that is authorized by Congressional legislation directing the USACE to construct and maintain a Federal navigation project; authorized depth may apply to specific port channels and not to the entire port or harbor area; 2) the maintained depth, which is the depth that is "suitable for the associated port traffic and cost-effective given budget limitations as determined by USACE; and 3) the controlling or limiting depth which governs the maximum draft for a vessel entering a channel. Channel depth is only one limiting factor, docking depth and pier length may also limit the number and type of ships that can be accommodated. The number, length, and depth of berths also determines the number and size of vessels a port can handle. Industry wide there is pressure for ports to increase channel depth and related berth depth; this is an expensive and time-consuming process. For example, the deepening of the Jacksonville, Florida Harbor to 47 feet is projected to require an investment of $484 million and take 5 to 6 years to complete; this does not include the time it took to receive Congressional approvals and for the U.S. Army Corps of Engineers to conduct studies. As the industry moves toward larger ships, ports are faced with making increased capital investments to improve maritime access. Channel and harbor deepening projects are essential to meet the needs of the larger cargo ships that are transiting the Suez and the Panama Canal as shipping lines continuously increase the TEU capacity of their vessels.

In addition to maritime access, land access from ports to markets is critical for efficiency and for growth. Ports require access to efficient inland distribution systems particularly to road and rail transportation. Many ports have invested heavily to develop rail corridors to facilitate inland access and to reduce truck congestion. There must be enough land-side capacity to assure the efficient, rapid discharge and loading of cargo to allow liner vessels to minimize ship dwell time; the usual dwell time for containerships is approximately 24 hours. Maritime traffic is highly concentrated to a limited number of large ports that have adequate maritime and land access, and sufficient infrastructure and equipment. Major ports have become primary gateways to vast continental distribution systems with access to high capacity inland distribution corridors and connections to rail, road, and pipeline distribution infrastructure. Many container terminals have rail transfer facilities (on-dock rail) to transfer containers to and from trains without having to move containers over-the-road by truck. Terminals that lack on-dock rail move containers via truck to and from rail terminals that may be off-dock or near-dock. On-dock rail transfer increases the acreage footprint required for port operations.

Ports may be monofunctional or polyfunctional. Monofunctional ports transit a limited array of commodities; these types of ports most often handle dry or liquid bulk shipments with piers and equipment that is specialized to handle specific commodities (e.g. oil ports or mineral ports). Polyfunctional ports handle a vast array of containers, bulk cargo, or raw materials.

The combination of increased ship size and the formation of alliances (consolidation) has important impact on port productivity and performance. With increased ship size, container berth productivity may be constrained by the growing volume of the number of boxes that must be exchanged during vessel calls, particularly at peak hours; this exerts increasing pressure on a ports' handling capacity. The need to handle more containers at the same time places constraints on berth, crane, and yard operations. A decline in handling capacity may also increase berth waiting times. Industry consolidation is also occurring as shipping lines are increasingly participating in the ownership and management of container port terminals through joint ventures and shareholdings. When shipping lines are

stakeholders in terminal operations, it may impact the selection of ports of call, influence the concessions that ports must make to container terminal operators, and be a determinant of the selection of ports of call.

Port Governance and Port Authorities

Ports are governed and organized in numerous ways. Port governance and ownership varies considerably between nations. For example, in China, ports are predominantly controlled through a dual-administration system being jointly controlled by the Ministry of Communications and local governments; joint ventures allow state-controlled shipping companies to invest in port terminals. In the European Union full ownership by the state or by the municipality is the predominant form of port governance; however, mixed public-private ownership models exist in many countries. The Piraeus Port Authority in Greece is one example of a mixed public-private ownership model; in 2016, China's COSCO Shipping Group acquired 67 percent of the shares of the Piraeus Port Authority, the Greek state owns 7 percent of the shares, and the balance of shares are held by private investors. The Port of Amsterdam is a limited liability company of which the City of Amsterdam is the main shareholder. Many ports in the United Kingdom are characterized by full private ownership. In the United States most ports are governed by port authorities or harbor districts that are governmental entities. For example, the Port Authority of New York and New Jersey is an interstate governmental body; the Georgia Port Authority and the Port of Gulfport are state entities.

Up until the late 1980s, public ownership and the operation of ports and port terminals were the predominant form of port governance. The limited ability of some governments to meet the need to modernize and to increase the efficiency of ports due to the expansion of containerization shipping were key factors in the privatization of port functions. By the 1990s ports had become major bottlenecks to the efficient distribution of goods, characterized by port congestion, chronic service failures, and deterioration of services. Recognizing the inability or unwillingness of many world governments to invest in expensive port infrastructure, the World Bank and the International Monetary Fund encouraged port reform to incentivize greater involvement by the private sector in the financing of port facilities, terminals, and services. Ports and port authorities have increasingly moved toward decentralization, commercialization, and modernization of port administration.

Port Authorities

Port Authorities are national, state or local governmental entities that own, operate, and provide wharf, dock, and other marine terminal investments and services at ports. The policy rationale for port authorities is their ability to manage port facilities more efficiently than privately owned and operated terminals. Port authorities may also be better positioned to raise investment capital and to mitigate the risk associated with the significant capital investment that is required to construct, manage, and maintain port facilities. Port authorities are required to interact with a broad continuum of constituency groups, these include: governmental entities, law enforcement agencies, policy makers, inspectors, and auditors; shipowners, ship managers, ship brokers, ship agents, ship chandlers, maritime officers and seamen; longshoremen, stevedores and unions; customs brokers, cargo forwarders and receivers, commodity brokers, banks and financial institutions underwriters; shipyards, repair and maintenance teams, and a range of port tenants. Port authorities are responsible for purchasing land, constructing, maintaining, and negotiating leases for facilities; they may also allocate space at indoor and outdoor

CATEGORIES OF PORT ASSETS

BASIC PORT INFRASTRUCTURE:

- Maritime access channels
- Port entrance
- Protective works, including breakwaters and shore protection
- Access to the port for inland transport (roads and bridges)
- Rail connection between the hinterland and the port
- Inland waterways within the port area and connecting port areas with the hinterland

OPERATIONAL PORT INFRASTRUCTURE:

- Inner port channels, turning and port basins
- Revetments and slopes
- Roads, tunnels, bridges, and locks in the port area
- Quay walls, jetties, and finger piers
- Aids to navigation, buoys, and beacons
- Hydro and meteorological systems
- Specific mooring buoys
- Vessel traffic management systems
- Security patrol and fire-fighting vessels
- Docks
- Port land (excluding superstructure and paving
- Access roads to general road infrastructure
- Rail connections to general rail infrastructure, and marshalling yards
- Dry docks for ship repairs

PORT SUPERSTRUCTURE:

- Paving and surfacing
- Terminal lighting
- Parking areas
- Sheds, warehouses, and stacking areas
- Tank farms and silos
- Offices
- Repair shops
- Other buildings required for port and terminal operations

PORT EQUIPMENT:

- Tugs
- Line handling vessels
- Dredging equipment
- Ship and shore handling equipment
- Cargo and container handling equipment (cranes, forklifts,

Source: The World Bank: Port Management Structures and Ownership Models, Port Reform Toolkit, Module 3

Figure 2: Categories of Port Assets

storage, warehousing, and terminal facilities. Historically, port authorities acted as landlord, regulator, and operator of the port. Generally, port authorities may act as:

- Landlords that build and maintain terminal infrastructure and provide major capital equipment but are not engaged in the actual operations of the port. Port authorities in "landlord ports" hire or negotiate lease contracts with private port terminal operators to operate their terminals. Examples of these types of ports are the Ports of Oakland and Los Angeles. In some cases, ports may provide incentives to tenants that are willing to make infrastructure improvements.
- Operating Ports directly operate some or all of the terminals within their jurisdiction. The Port Authority of Houston is an operating port.
- Jurisdictional bodies with private terminals that are responsible for providing and operating their own infrastructure. The Port Authorities of Northern Kentucky and Cincinnati are jurisdictional bodies.
- Private port terminals may or may not fall within the jurisdiction of port authorities. Many Ro/Ro terminals, dry bulk, and liquid bulk terminals are owned and operated by private firms. Private terminals generally fall within three categories:
    1) Terminals owned and operated by marine terminal operators that provide cargo handling services and derive revenue from providing these services;
    2) Terminals owned by operators with special cargo interests that derive revenue from the cargo itself or by processing the cargo rather than by providing transportation or terminal services; this may include grain terminals owned by grain exporters or petroleum terminals owned by refinery owners; and
    3) Terminals owned by barge or vessel operators to serve their own operations; the primary source of revenue for these terminals is derived from the transportation services.

Port authorities may own and operate a broad range of facilities and assets that encompass large areas of land and have multiple facets that are not water related. For example, the Port Authority of New York and New Jersey operate airports, bridges, tunnels, and transit systems in addition to seaport facilities and infrastructure. Port assets fall into many categories, to include: 1) basic port infrastructure, 2) operational port infrastructure, 3) port superstructure, and 4) port equipment (Figure 2 page 18). Port authorities have a variety of options for financing operational infrastructure. For landlord ports that are comprised predominantly of self-contained terminals, ports authorities may provide the land while terminal lessees finance the investment for the terminal and in some cases private partners also invest in other elements of the infrastructure.

In the United States, public port authorities frequently have access to public funds (e.g. general obligation bonds) and access to other capital that provides them with "cheaper" money when compared to the private sector. In these cases, a port authority finances some combination of port assets and then relies upon revenue generated by the operation of new facilities and equipment to repay debt; these revenues are usually generated by entering into a public-private partnership that takes the form of a long-term lease contract running for a period of 20 to 30 years. This method of financing operational infrastructure also assures purchasers of debt that the governmental entity will make repayments if operational revenue from leases is inadequate. A dilemma faced by port managers in the negotiation of leases is the need to balance the surety of revenue streams by negotiating long-term leases with the

flexibility of bargaining power that is provided by short-term leases. Once a long-term lease contract is negotiated, the port cannot profit from future increases in demand or market growth; when shorter-term leases are negotiated, the port can benefit from increased demand, changing markets, and economic growth. Some port authorities negotiate more flexible lease agreements that enable them to receive fixed annual fees that are augmented or adjusted annually based upon leaseholder's performance, profit, or productivity.

Other port assets and functions such as pilotage, tugboat operations, mooring services, waste management, or dredging services may be privatized. Port assets and services that are normally retained within the public domain include: the control of dangerous goods, harbormaster functions, port police and security functions, customs services, vessel traffic services, and other aids to navigation.

As ports move towards the increasing privatization of some assets and services, there remain many categories of port infrastructure for which it is difficult to find private sector investors. As with all transportation investments in expensive and long-lived infrastructure and equipment (channels, breakwaters, wharfs, berths, cranes, and coastal protection structures) with life-spans that often exceed 50 to 100 years and require significant sunk cost investment, port authorities will remain the primary mechanism for the public sector to invest in the port infrastructure that is required to support state, regional, and national economies.

IV. The Port of Gulfport

The Port of Gulfport is located on the Gulf Coast in southern Mississippi, it is five nautical miles from the Gulf Intracoastal Waterway. The port is governed by a five-member commission; three commissioners are appointed by the Mississippi Governor; one commissioner is appointed by the Gulfport City Council and one commissioner is appointed by the Harrison County Board of Supervisors. The Deep-Water Port encompasses 300 acres with approximately 6,000 feet of flexible berthing space across 10 vessel berths at two terminals (West and East Pier Terminals). The port provides 110 acres of open storage space and 400,000 square feet of covered warehouse space contained within four warehouses, two of which have direct Class 1 rail access provided by the Kansas City Southern Railway Company. There is an additional Ro/Ro berth located in the West Pier Terminal. The port has facilities to handle containerized and bulk cargo including a 100-ton capacity mobile harbor crane and three ship-to-shore rail mounted gantry cranes with the capacity to move 35 to 37 containers per hour. The port provides bulk, breakbulk, and containerized cargo services. The primary commodities moved through the port include fresh produce, frozen poultry, apparel, automobiles, and ore. There are additional facilities at the nearby 114-acre inland port facility (located six miles north of the Deep-Water Port) that offer rail access and barge connections. There is also a small craft harbor located at the port where the Department of Marine Resources operates an Oyster Hatchery in partnership with the University of Southern Mississippi and the Mississippi Department of Rehabilitation Services.

The authorized channel depth of the Port of Gulfport is 36.0 feet and the maximum depth of the approach channel is 38.0 feet;[8] the dredging of the channel to its full authorized depth was completed in 2015. In November 2017, the U.S. Army Corps of Engineers released a *Record of Decision on the Port of Gulfport Expansion* project that paved the way for a significant port expansion which included a 282-acre dredge and fill program for the expansion of the West and East Pier Terminals and a 4,000 linear foot breakwater system.

In 2005, Hurricane Katrina devastated the economy and infrastructure of south Mississippi; the destruction of the infrastructure and equipment at the Port of Gulfport crippled the operations of the port and negatively impacted commercial activity. In 2007, a plan was submitted to the U.S. Department of Housing and Urban Development (HUD) to request funding to restore the port's infrastructure and facilities that had been destroyed by Hurricane Katrina. The Mississippi Development Authority's request to HUD stated that the purpose of the Port of Gulfport Restoration Program was to "*facilitate the restoration of the port's infrastructure and facilities, to provide for the long-term recovery of the port's operating capacity, and to provide mitigation against future damage*." In 2007, the HUD Secretary authorized the reprogramming of up to $600 million in Community Development Block Grant (CDBG) disaster recovery; in 2009, the action plan was amended to expand the capacity of the port to serve a more diverse market. In May 2011, HUD approved the final release of funding which allowed the state of Mississippi to fully restore and revitalize the Port of Gulfport. After multiple years of complex planning and permitting processes, the construction phase of the $570 million expansion and restoration of the Port of Gulfport was completed on December 1, 2018.

[8] https://www.bts.gov/sites/bts.dot.gov/files/portprofiles/2018/Gulfport.pdf

Figure 3: Timeline of Major Events Impacting Coastal Mississippi

Background on Port of Gulfport Revitalization

Hurricane Katrina was the most destructive hurricane to strike the United States. After making its first landfall in Florida, Hurricane Katrina made its' second landfall at 6:10 a.m. on August 29, 2005 as a strong Category 4 hurricane near Buras Louisiana in Plaquemines Parish, with recorded wind speeds of over 140 miles per hour and its third landfall on the Mississippi/Louisiana border near Pearlington, an unincorporated community in Hancock County, with recorded wind speeds of 125 miles per hour. With combined high winds and a storm surge that exceeded recorded maximums of up to 28 feet, Katrina wrought devastation to homes, schools, businesses, and important historic landmarks across the Louisiana and Mississippi Gulf Coast. This unprecedented disaster destroyed wide swaths of Louisiana and Mississippi, destroying the lives and communities of people across the Gulf Coast. The destruction wrought by Katrina displaced thousands of people and placed enormous burdens on governmental agencies as they sought to provide essential services to citizens. According to the National Hurricane Center's September 2017 report, the Katrina "*damage estimate is $161.3 billion in 2017 dollars – making it the costliest U.S. tropical cyclone.*"

Beyond the impact of Hurricane Katrina, there have been multiple intervening events that have negatively impacted economic activity nationwide, the region, and the state of Mississippi having a devastating impact on the economy and local business establishments in Mississippi's coastal counties of Harrison, Jackson, and Hancock. Among these events were the Great Recession, which began in December 2007 and ended in June 2009, and the oil spill resulting from the fire and explosion on the Deepwater Horizon in April 2010 (Figure 3 above). The Deepwater Horizon oil spill was an economic catastrophe for Mississippi's gulf coast. Its greatest impact was on the commercial fishing and processing industry and on tourism related businesses – hotels, restaurants, recreational fishing, and water sports – the April 20th timing of the spill came just prior to the peak tourism season on the Gulf Coast which begins in mid-May and extends through Labor Day. The subsequent moratorium on drilling and delays in issuing deep water drilling permits reduced the number of permits issued by 66 percent during the 13 months following the spill, causing a decline in oil field employment and related services. Other events not shown in Figure 3 include the significant economic effect on overall consumption spending related to the run-up in oil prices to a high of $145 per barrel in July of 2008 during the Oil Shock of 2007 — 2008, the Global Trade Collapse which resulted in a 12.5 percent decline in global trade in 2008 —2009, and the Mississippi River floods of 2011. These intervening events add an additional layer of complexity to disaggregating the economic effect of the reconstruction of the Port of Gulfport from the events that have negatively impacted economic activity in the region.

In addition to multiple intervening macro- and micro-economic events, the restoration and revitalization of the Port of Gulfport must be examined within the context of the magnitude of complexity required to complete port construction projects. The restoration of the Port of Gulfport required a comprehensive pre-planning process to identify the strategic long-term and short-term direction of the port requiring the examination of land use and future economic development strategies. Comprehensive pre-planning included strategic plans to outline the port's market position and future direction to define specific projects that would be required to achieve specific goals. The pre-planning process consisted of a thorough throughput analysis of inputs, constraints, and outputs that examined historical and forecasted projected demand, throughput mixes, modal profiles, storage dwell times, arrival patterns, equipment productivity and peaking factors. Due to the complexity of the land-marine interface, port construction activities operate within a stringent regulatory and permitting process which encompasses land use, security, health and safety, environmental considerations, and labor issues. The port pre-planning process included the oversight, review, and approval of multiple federal agencies including, but not limited to: the U.S. Environmental Protection Agency, the U.S. Fish & Wildlife Service, and the U.S. Army Corps of Engineers (USACE); review and approval also was required by multiple state agencies, e.g. the Mississippi Department of Marine Resources, the Mississippi Department of Transportation, state environmental regulators, and approval by the state legislature and/or the governor.

Each element of the port restoration project required planning, design and engineering, e.g. design of terminals, terminal components, terminal capacity, and terminal dimensions; in most cases, each element of the project required additional submissions for review and approval by regulators. Concurrent financial due diligence, risk analysis, and financial feasibility were also undertaken during the preliminary planning process. Depending upon the specific project, pre-planning activities took months or years to complete. For example, the initial permit application for the restoration of the Port of Gulfport was filed on March 17, 2010 with the U.S. Army Corps of Engineers. Subsequent to the initial filing, modifications were made to the proposed project footprint; upon completion of its environmental impact assessment of the proposed modifications, the USACE held a public scoping meeting approximately one year later, on March 31, 2011. An additional delay in project completion occurred when the March 17, 2010 application was modified on April 16, 2013 by the Mississippi State Port Authority to request a deepening of "the channel depth to up to 47 feet and modification to navigation features adjacent to the port facilities to include deepening of the existing federal turning basin area and port berthing areas, a turning basin expansion, and new berthing areas."[9] Channel deepening engineering studies typically take one year or more to complete requiring hydrographic surveys, geotechnical field work, hydrodynamic modeling, ship simulations and dredge material management plans — the environmental impact study (EIS) is completed by the U.S. Army Corps of Engineers, but funding has to be approved by Congress and included in federal budgets. Upon completion of pre-planning activities and upon the receipt of required regulatory approvals, a project element is moved into the final solicitation and financing phase; at this point, requests for qualifications were issued and reviewed, then requests for proposals were published and evaluated resulting in the selection and negotiation of construction contracts. Actual physical construction activities for each project could only being upon completion of the lengthy planning and approval process.

[9] Department of the Army Permit No: SAM-2009-1768-DMY http://www.portofthefuture.com/wp-content/uploads/bsk-pdf-manager/7_Stakeholder-without-Newsletter_050213-1.pdf

The Port of Gulfport restoration project consisted of approximately 30 separate construction project activities, including: port elevation, seawall construction, site preparation, fill, grading, and construction of storm water management systems for the 300-acre site; the upgrade of electrical power substations and the construction of a new distribution center by Mississippi Power Company; the dredging, elevation and construction of the West Pier. As previously explained, the pre-planning design, engineering, construction, and completion of critical project elements took many years.

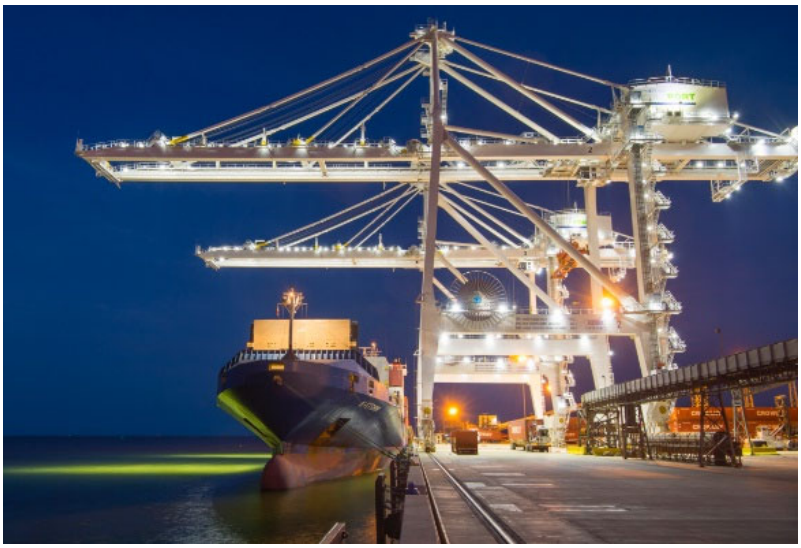


Image 2: Rail Mounted Gantry Cranes at the Port of Gulfport

Much of the Port of Gulfport's infrastructure and equipment that will improve the port's competitive position in the market has only been completed within the last few years. For example, wharf crane rail upgrades were completed in 2017 and the delivery and installation of three ship-to-shore rail mounted gantry cranes for handling containers was completed in 2016. The restoration of the Port of Gulfport addressed many factors in the maritime sector value chain to include: in 2015, a maintenance dredging project by the USACE returned the shipping channel to its authorized depth of 36 feet, improved loading/unloading equipment to increase containerized throughput, improved terminal facilities, a Container Freight Station and open storage with reefer plug outlets. The Port of Gulfport is a diversified port that handles bulk, breakbulk, and containerized cargo. The Gulfport/Biloxi Foreign Trade Zone (FTZ 92) is located near the custom's port of entry at the Port of Gulfport, carriers can unload, exhibit, store, repackage and manipulate goods in the FTZ. The port is strategically located on the Gulf of Mexico, approximately five miles from the Gulf Intracoastal Waterway and 16 miles from the shipping lanes. Intermodal cargo transfer capabilities at the Port of Gulfport include vessel-to-vessel, vessel-to-rail, and vessel-to-truck transfers. Approximately 45 truck lines serve the Port of Gulfport; the port has direct access to U.S. Route 49 and is within 10 minutes from Interstate Highway 10 allowing trucks to readily reach three-quarters of the U.S. consumer market. Rail services are provided by the CSX and Kansas City Southern Railways providing connections to the Illinois Central Railroad and to Canadian National.

The Port of Gulfport is the third largest container seaport on the Gulf of Mexico and is the 2nd largest importer of green fruit in the United States. Primary cargo carriers using the port include the *Great White Fleet* (Chiquita) that serves Honduras, El Salvador, and Guatemala; *Crowley Maritime* which serves Guatemala, Honduras, El Salvador, and Nicaragua; and *Dole Ocean Cargo Express* — Dole operates the largest dedicated refrigerated fleet of containers in the world.

In November 2015, the Port of Gulfport was designated as a Strategic Seaport. The Port of Gulfport is one of 17 commercial ports in the United States designated as a Strategic Seaport by the U.S. Department of Defense in conjunction with the U.S. Department of Transportation's Maritime Administration. Strategic seaports are designated because of their ability to support major military force and material deployments in times of war and national emergency. To receive designation under the Strategic Seaport Program (SSP) required a two-year application, review, preparation and vetting process to ensure the port was able to meet the needs of the United States' armed forces, including training of personnel, planning for how the port will be used during a contingency, and adequate security. Even in times of peace, the military is a significant shipper of cargo, equipment, and personnel; SSP designation further diversified the potential of the Port of Gulfport to handle a wider range of cargo and shipments. The SSP designation of the port is well aligned and integrated with the objectives of the *Mississippi Defense Diversification Initiative* (MDDI), a partnership between the U.S. Army Economic Research and Development Center (ERDC), the U.S. Naval Research Laboratory, the University of Southern Mississippi, Mississippi State University, and the University of Mississippi, and Defense Contractors in the state of Mississippi. The goal of this initiative is to enhance the economic diversification of the state of Mississippi and to design and develop strategies to transition from heavy defense-oriented models to commercial models that create new opportunities and revenue streams for defense related businesses, entrepreneurs, researchers, and scientists.

The Port of Gulfport currently has eight maritime tenants including: Dole Fresh Food Company, Chiquita Brands International, Chemours, Gulf Coast Shipyard Group, Inc., McDermott International, Inc., Topship, LLC., Crowley Maritime Corporation, and the University of Southern Mississippi. The Island View Casino Resort is a non-maritime port tenant.

In 2017, the U.S. Department of Transportation added the Port of Gulfport to its list of the 25 most active ports in the United States based upon TEU throughput.[10] Over the period from 2016 to 2017, Vessel Calls at the Port of Gulfport increased by 278.4 percent; dry bulk vessel calls increased by 40.5 percent and container vessel calls increased by 24.5 percent (Table 3 below).

Table 3: Port of Gulfport Throughput by Vessel Calls

Throughput by Vessel Calls	2017	2016 to 2017
Total Vessel Calls	**1,001**	**278.4%**
Container Vessels	158	24.5%
Average TEU per container vessel	1,376	5.4%
Dry Bulk Vessels	26	40.5%
Average dry bulk short tons per dry bulk vessel	32,945	10.0%
Dry Bulk Barge	15	**-87.3%**
Average dry bulk short tons per dry bulk barge	1,382	**-10.8%**
Other freight vessels	3	20.0%

Source: U.S. Department of Transportation; Port Performance Statistics Program: Annual Report to Congress 2018

[10] Source: U.S. Department of Transportation; Port Performance Statistics Program: Annual Report to Congress 2018

Table 4: Port of Gulfport Total Tonnage 2017

Total Tonnage (Millions of Short Tons)	2017	2016 to 2017
Total (Domestic & Foreign)	**2.3**	**19.8%**
Domestic	0	-88.7%
Foreign	2.3	30.7%
Imports	1.8	36.3%
Exports	0.5	14.6%

Source: U.S. Department of Transportation; Port Performance Statistics Program: Annual Report to Congress 2018

Table 5: Port of Gulfport Commodities Throughput 2017

Commodities Throughput (Millions of Short Tons)	2017	2016 to 2017
Total Tonnage	**2.3**	**19.8%**
Non-Ferrous Ores	0.7	51.2%
Bananas	0.6	19.1%
Textile Products	0.2	-8.6%
Paper & Paperboard	0.2	26.2%
Limestone	0.2	19.7%
All Other	0.3	-2.4%

Source: U.S. Department of Transportation; Port Performance Statistics Program: Annual Report to Congress 2018

The U.S. Department of Transportation reported 2017 throughput at the Port of Gulfport was 2.3 million short tons representing an increase of 19.8 percent above total tonnage in 2016 (Table 4). As shown in Table 5, the largest increase in commodity throughput tonnage occurred in non-ferrous ores (51.2 percent), followed by an increase of approximately 19 percent in bananas and limestone. Paper and Paperboard commodities throughput increased by 26.2 percent (Table 5).

Each port in the United States has different infrastructure, equipment, governance, modal connections, operating processes, and handles a different mix of cargo; therefore, direct comparisons are highly problematic. The U.S. Bureau of Transportation Statistics created the Port Performance Freight Statistics Program (PPFSP) pursuant to Section 6018 of the Fixing America's Surface Transportation (FAST) Act. The goal of the program is to provide nationally consistent measures of performance for the largest ports in the nation. Basic measures of the annual percentage change in tonnage, TEU, vessel calls, and commodity throughput provide a perspective on relative port performance (Table 6 below). The Port of Gulfport exhibited positive performance over the period from 2016 to 2017 demonstrating a 31.2 percent increase in container volume, a 24.5 percent increase in container vessels, and a 19.8 percent increase in total tonnage over the period (Table 6).

Table 6: Comparative Performance Measures for Selected Ports 2017

Port	Container Shipments in 1,000 TEU				Percent Change in Container Volume 2016 to 2017 (1,000 TEU)	Container Vessel Calls 2017
	Loaded Inbound	Loaded Outbound	Empty Inbound and Outbound	Total TEU		
Gulfport	98	81	38	217	31.20%	158
Boston	130	88	53	271	9.10%	194
Mobile	154	174	0	328	20.70%	295
Palm Beach	134	141	0	275	2.90%	244
New Orleans	114	274	138	526	0.70%	557
Wilmington, DE	188	72	116	376	3.50%	157
Wilmington, NC	75	115	57	247	-4.90%	325

Port	Container Terminal Acres	Number of Ship-to-Shore Gantry	Percent Change 2016 to 2017		
			Vessel Calls	Container Vessels	Total Tonnage (Millions of Short Tons)
Gulfport	145	3	278.40%	24.50%	19.80%
Boston	90	6	65.20%	23.20%	-3.30%
Mobile	90	2	5.50%	37.60%	0.20%
Palm Beach	156	0	75.30%	9.90%	3.70%
New Orleans	61	6	6.30%	10.00%	6.70%
Wilmington, DE	70	2	79.10%	0.30%	-8.20%
Wilmington, NC	80	6	56.90%	17.80%	1.90%

Source: U.S. Department of Transportation; Port Performance Statistics Program: Annual Report to Congress 2018

At the time of this study, the most recent port performance data available from the U.S. Department of Transportation was for 2017. To examine more recent performance, the Stennis Institute requested data for 2018 from the Mississippi State Port Authority — this data is presented in Figure 4 and Figure 5 below. It is important to note that the data reported by the Mississippi State Port Authority is not directly comparable to the data reported by the Port Performance Freight Statistics Program of the U.S. Bureau of Transportation Statistics due to reporting periods and methodology. However, data reported by the Mississippi State Port Authority (MSPA) for 2017 is not significantly different than the data reported by the U.S. Department of Transportation Statistics (U.S. DOT), with the exception that 2017 TEU throughput reported by the MSPA is slightly lower than that reported by the U.S. DOT.

In 2017, the combined vessel calls at the Port of Gulfport associated with cargo voyages was 202, this increased to 212 vessel calls in 2018. From 2014 to 2015, tonnage and TEUs at the Port of Gulfport declined by 16 percent and 24 percent, respectively, after Chiquita Brands moved its operations to the Port of New Orleans in 2014 (Figure 4 and Figure 5 below); Chiquita returned to the Port of Gulfport on July of 2016. Over the period from 2016 to 2018, cargo shipment tonnage at the Port of Gulfport increased by 35.1 percent and cargo shipment TEU increased by 48.2 percent (Figure 4 and Figure 5). Examination of the data in Figure 4 and Figure 5 below, indicates that tonnage and TEU at the Port of Gulfport have increased since the advent of Katrina and that tonnage and TEU throughput increased in 2018 as compared to 2017. The Port of Gulfport shipped 2.4 million tons of inbound and outbound cargo shipments in fiscal year 2018 and TEU cargo throughput was 206,196.

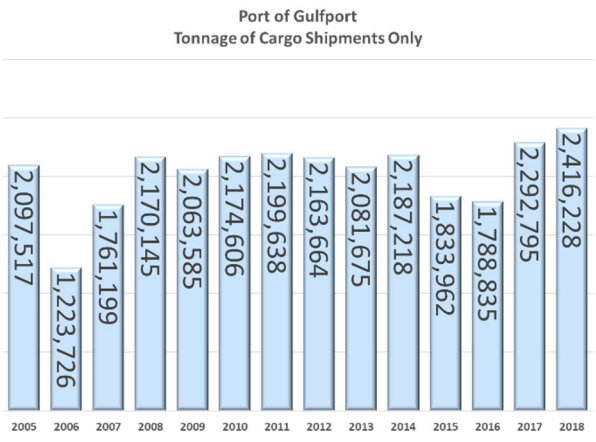


Figure 4: Port of Gulfport Tonnage of Cargo Shipments

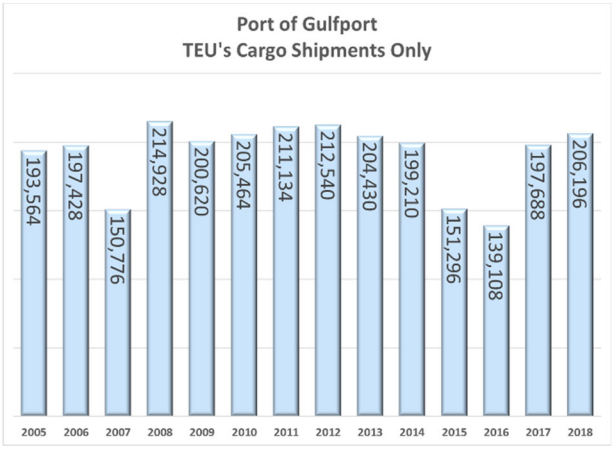


Figure 5: Port of Gulfport Cargo Shipments in TEU

Maritime Services Providers, Employers, and Workers at the Port of Gulfport

Stevedoring and Longshoremen at the Port of Gulfport

Tenants at the Port of Gulfport require a highly trained and flexible workforce to load, unload, and move cargo around the port; tenants and other port users contract with commercial stevedoring companies to secure longshoremen to perform these tasks. The Gulfport Stevedore Association (GSA) works with the International Longshoremen's Association (ILA) Local #1303 to secure workers for the two terminal operators and stevedores —Ports America and SSA Marine — located at the Port of Gulfport.

Ports America is the largest terminal operator and stevedore in the United States with operations at more than 42 ports across the nation. At the Port of Gulfport, Ports of America provides container, RoRo, breakbulk, and terminal services at both the East and West Pier. Ports America is a leader in creating public-private partnerships; it is the largest employer of ILA workers in the United States. Ports America employs 12 FTE workers at the Port of Gulfport; these employees are included in the number of direct in-port maritime service workers presented in Table 7 on 45.

SSA Marine has global marine terminal and rail yard operations in approximately 250 locations across five continents; it is the second largest terminal operator and stevedore in the United States. SSA Marine employs approximately 7 full-time equivalent employees at its facility at the Port of Gulfport; these employees are included in the number of direct in-port maritime service workers presented in Table 7 on 45.

Background on the International Longshoremen's Association (ILA)

The Longshoremen's Union Protective Association (LUPA) was organized in 1864 in the port of New York; it was the first longshoremen's union formed in the United States. The National Longshoremen's Association (ILA) was founded in 1892; three years later it joined the American Federation of Labor and was renamed International Longshoremen's Association when Canadian longshoremen were admitted to membership. In 1914, LUPA was absorbed into the ILA and the ILA continued to expand its membership throughout the Great Depression. During World War I, ILA leader Jeff Davis coined the slogan "I Love America (ILA)" to express the deep patriotism and important role of the ILA in the history of the nation. Today, with over 65,000 members, the International Longshoremen's Association AFL-CIO is the largest union of maritime workers in North America.

Two laws, the Norris – LaGuardia Act of 1932 and the Wagner Act of 1935, facilitated the growth of the ILA. The Norris-LaGuardia Act sponsored by two Republicans, Senator George Norris (Oklahoma) and Representative Fiorello La Guardia (New York), and signed into law by President Hoover, established that workers could form a union without employer interference, prevented the use of injunctions to prevent picketing and strikes, and prohibited the enforcement of yellow-dog contracts by federal courts. The Wagner Act of 1935 created legally enforceable rights for union workers; it guaranteed the rights of workers to vote for their own representatives and created an environment that allowed the union to grow. In the years following the passage of these two laws, union membership grew rapidly; in 1945, union membership peaked at 35.4 percent of total nonagricultural employment in the United States (27.1 percent of all employed workers).[11] During this period, ILA membership was approximately

[11] Mayer, G. (2009). *Union Membership Trends in the United States*. Washington, DC: Congressional Research Service, Federal Publication

100,000. In 1934, the ILA Pacific Coast District locals left the ILA to form the International Longshore and Warehouse Union.

According to the Constitution and Rules of Order of the International Longshoremen's Association, AFL-CIO, the ILA is divided into two (2) districts 1) the Atlantic district and 2) the South Atlantic and Gulf Coast District. Longshoremen working on the West Coast of the United States are represented by the International Longshore and Warehouse Union (ILWU); the International Longshoremen's Association (ILA) negotiates labor contracts for port workers on the East Coast and Gulf Coast of the Unites States. The ILWU and ILA do not work in tandem or simultaneously orchestrate union activities or contracts; in many cases, ports on the West Coast compete with ports on the East/Gulf Coast based upon cost, proximity to inland destinations, efficiency and services. For example, West Coast ports were closed for 10 days during 2002, when the Pacific Maritime Association (PMA) and the ILWU failed to come to agreement on a master contract; during this time many shippers diverted their ships to ports on the East Coast. Since the widening of the Panama Canal in 2016, East Coast ports have become increasingly competitive with those on the West Coast.

Productive labor relations are essential to maintaining efficient business activity at ports across the nation and the world. Longshoremen are critical workers that contribute to assuring the efficient and safe operations of ports, their work entails:

- Moving cargo to and from ships and around docks using heavy machinery such as rail-mounted gantry cranes, forklifts, utility tractor rigs
- Inspect and document cargo containers using manual and automated data processing systems
- Manual labor to lift and push heavy loads
- Tying and untying cargo and securing shipments
- Reporting unsafe or damaged cargo to supervisory personnel

The work of longshoremen is physically demanding and dangerous; they work in proximity to heavy cargo, moving heavy equipment and machinery. Working with lashing wires or rods, lines, container hooks, twist locks and turnbuckles presents an array of hazards, as do falling containers, moving vehicles, slips, falls, and other hazardous conditions. They also work in all types of weather conditions, from extreme cold to extreme heat and in dry or raining conditions. Due to long hours and unpredictable schedules, longshoremen tend to live close to the ports at which they work.

Shippers on the West Coast are members of the Pacific Maritime Association, this organization negotiates master labor contracts with the ILWU. Shippers on the East/Gulf Coast are members of the United States Maritime Alliance (USMX), this organization negotiates master labor contracts with the ILA. Unions set the rate of pay for longshoreman based upon the year they joined the union and their years of experience. Based upon recent union contracts (2017), the starting hourly wage for an ILA member is $20 per hour (excluding additional pay for overtime, nighttime, weekend or holiday work); after two years of work experience, the hourly pay increases to $23.75 per hour. After four years of experience, hourly pay increases to $29.40 per hour and then to $35.00 per hour after six years of experience. The average annual longshoreman's salary is $53,000 with zero to five years of experience and $81,000 for longshoreman with between 10 and 20 years of experience.

The Longshore and Harbor Workers' Compensation Act (33 U.S.C. 901 et seq.) is a federal law that provides for the payment of compensation, medical care, and vocational rehabilitation services to workers disabled from on the job injuries that occur working on the navigable waters of the United States. "Working on the water" includes jobs performed on any of the navigable waterways in and around the continental United States, piers, docks, terminals, wharves, and loading areas adjoining the water. The Act also offers benefits to dependents if an injury causes an employee's death. LHWCA compensation is generally based on an employee's average weekly wages at the time of injury or death; compensation is capped at a maximum of twice the applicable fiscal year's national average weekly wage (Department of Labor, Office of Workers' Compensation Programs 20 CFR Part 702).

To become a member of the ILA, workers generally begin as "*casual*" workers, these casual workers are not union members. During high traffic times, when the demand for workers exceeds the supply of union members, *casual* workers are selected by the local union through a lottery-style drawing of available workers. *Casual* workers work on standby; they have highly erratic schedules and uncertain hours; they receive no union health insurance or union pension benefits. After proving to be dependable and gaining experience, a *casual* worker will be recognized as an "*identified casual*" and provided with an identification card; although "*identified casual*" workers are not union members, they will be given preference over "*unidentified casual workers*" when work is available. Upon becoming an "*identified casual worker*," application can be made to become a union member when the union is seeking to expand its membership. Upon acceptance into the union, longshoremen are given preference for all available work and provided with the full benefits available to union members; however, they are not obligated to take any work that is offered. Becoming a member of the ILA can take many years, it is a highly competitive process due to the high wages and benefits that are associated with being a union member.

All local unions must hold a charter from the ILA.; ILA Local #1303 is located at 2004 30th Avenue in Gulfport, it is the union from which longshoremen are recruited to work at the Port of Gulf. ILA Local #1303 reports 388 active members on its website;[12] this number includes only union members, it does not include *casual* or *identified casual workers*. ILA Local #1303 employs five workers, to include Darius Johnson, President and Chris Johnson, Vice President.[13]

When longshoremen are needed to load and unload cargo vessels at the Port of Gulfport, the tenants or port users contract with stevedoring firms (e.g. SSA or Ports America) through the Gulfport Stevedore Association (GSA) to secure workers. Appropriate levels of staffing for specific tasks are determined based upon International Longshoremen's Association (ILA) collective bargaining agreements and then the ILA Local #1303 is contracted to provide the labor needed by the stevedores. When ILA members are working at the port, an ILA foreman maintains daily timesheets for all workers; these timesheets are then reviewed and approved by representatives of the stevedores. The stevedores process the timesheet data, submit documentation, and make appropriate payments to the GSC-ILA Welfare Plan based upon the total documented hours worked by ILA members; the stevedores' payroll departments verify relevant timesheet information and then sends the processed timesheet data to a payroll processing vendor who makes appropriate withholdings from wages and remits payments to the

[12] https://www.unionfacts.com/lu/23577/ILA/1303. Accessed April 20, 2019.
[13] Ibid.

appropriate authorities. The payroll processor then will either: 1) submit a report to a stevedore's payroll department which then writes the payroll checks and prepare a paystub for each ILA member; or 2) cut paychecks directly and deliver all paychecks, paystubs, and supporting documentation to the stevedore. The stevedore then provides the paychecks, paystubs, and supporting documentation to the ILA Local #1303 for distribution to ILA members. The ILA provides the Mississippi State Port Authority with copies of the GSC-ILA disbursement reports for the total number of hours worked by all ILA members; these man-hour reports include union members, casual, and identified casual workers. This study used the data from the GSC-ILA disbursement reports to calculate ILA Longshoremen FTE (Figure 6 below).

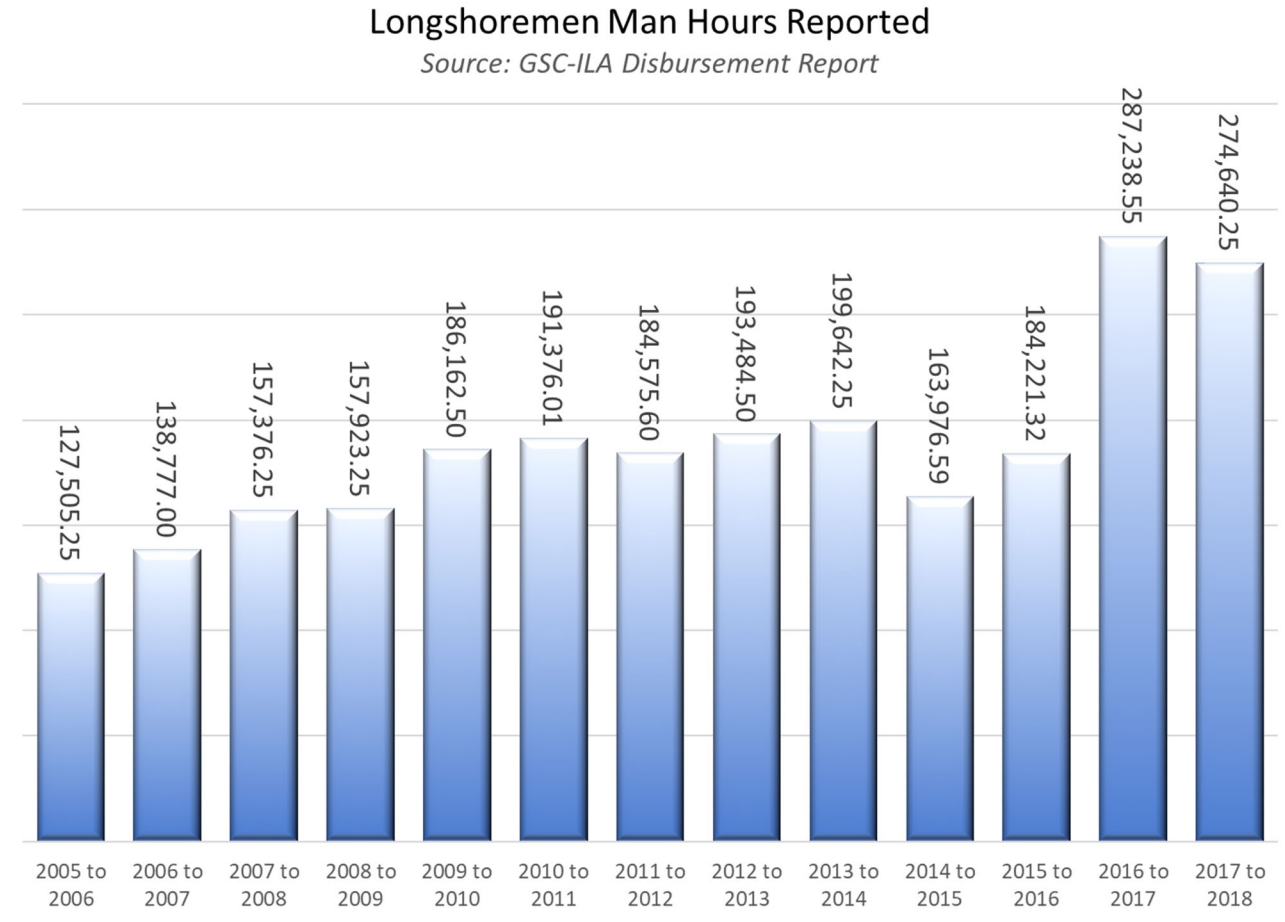


Figure 6: Hours Worked by ILA Longshoremen for 12-month Period October 1 to November 30, 2005 - 2006 through 2017 - 2018

For purposes of developing a baseline conservative benchmark to estimate full-time equivalent employment of longshoremen at the Port of Gulfport, the research team selected to use 1,820 hours of work (35 hours per week) over a 12-month period. Based upon this assumption, approximately 157.8 full-time equivalent jobs for longshoremen were created at the Port of Gulfport over the 12-month period from October 2016 to September 2017 (based upon 287,238.55 hours worked); over the 12-month period from 2017 to 2018, approximately 150.9 full-time equivalent jobs for longshoremen were created at the port (based upon 274,640.25 hours worked) — see Figure 6, above.

The Stennis Research team recognizes that there are numerous definitions of what constitutes "full-time" employment. According to the U.S. Department of Labor: "*the Fair Labor Standards Act (FLSA) does not define full-time employment or part-time employment. This is a matter generally to be determined by the employer."* Generally, the definition of full-time employment is determined at the discretion of the employer and is used to define which employees have a legal claim to receive benefits. There are specific federal laws that define full-time employment. One example is the Family and Medical Leave Act (FMLA), it requires employers with 50 or more employees to provide employees with up to 12 weeks of unpaid leave due to serious health conditions; to qualify, an employee must have worked for the employer at least 1,250 hours during the 12 months immediately before the date the FMLA leave begins. Another example is the Patient Protection and Affordable Care Act (PPACA) which states that a full-time employee is defined as an employee who works on average 30 or more hours per week during the calendar month, or at least 130 hours during the calendar month. To be eligible for disability and life insurance benefits, active ILA Local members must work or receive credit for 1,000 hours of service during the most recently ended contract year (the period beginning on October 1 and ending the next September 30); to be eligible for benefits under the ILA Vacation and Holiday Fund, ILA longshore workers must work and/or receive credit for a minimum of 700 hours during the eligibility year. For these reasons, the research team believed that defining "full-time" employment as working 35 hours per week or 1,820 hours over a 12-month period represents a conservative estimate of the number of full-time equivalent jobs that are created for longshoremen at the Port of Gulfport. Based upon this assumption, there were 150.9 full-time equivalent longshoremen employed at the Port of Gulfport over the one-year period from October 1, 2017 to September 30, 2018 (Figure 7, above). Longshoremen are defined as direct on-port maritime service workers and reported in Table 7 on page 45.

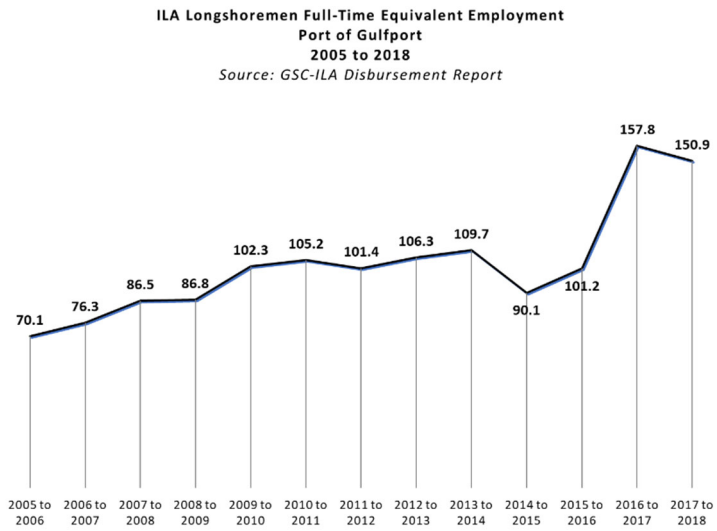


Figure 7: ILA Longshoremen Full-time Equivalent Employment

As shown in Figure 6 on page 31, and in Figure 7 above, employment of ILA longshoremen at the Port of Gulfport exhibited a relatively steady, but slow, increase over the period from 2005 through 2014 as the Port of Gulfport recovered from the impact of Hurricane Katrina. Over the period from 2014 to 2015, when Chiquita Brands International moved its shipping operations to the Port of New Orleans, employment for longshoremen dropped significantly. Chiquita returned to the Port of Gulfport in July of 2016 upon signing a new 40-year lease. Beginning in 2015, employment of longshoremen at the Port of Gulfport exhibits a significant increase, growing by approximately 67.5 percent from 2014 to 2018; much of this growth can be attributed to the return and expanded operations of Chiquita Brands International, as well as a general increase of activity at the port.

Chiquita Brands International, Inc. grows, procures, markets and sells bananas, fresh fruits, and vegetables under its brand name. The company is a privately held global corporation that employs approximately 20,000 employees across 25 countries and has a presence in about 70 countries. The Great White Fleet is a subsidiary of Chiquita Brands International; headquartered in Charlotte, North Carolina, the Great White Fleet acts as the shipping and logistics arm for the parent company. The Great White Fleet uses a fleet of owned and chartered ships to transport dry and refrigerated containerized cargo; it also provides integrated trucking as well as ocean services. In 2018, worldwide banana exports totaled approximately $13.6 billion (U.S.); this was an increase of 22.5 percent on average for all banana shippers over the five-year period starting in 2014.

Image 3: Chiquita Brands Refrigerated Reefers

Chiquita returned its shipping operations to the Port of Gulfport in July 2016 and doubled its terminal space; it occupies a new maintenance and repair building, utilizes a 110,000 square foot warehouse in the new West Terminal Transit Shed and 20,000 square feet of newly constructed temperature-controlled facilities.

Chiquita works with Ports America for stevedore services and to contract longshoremen to load and off-load cargo; it also directly employs approximately 12 full-time workers at its facility at the port. Chiquita provides a full range of benefits to include medical, dental, vision, life insurance, and retirement. In this study, all workers employed by Chiquita are considered to be maritime service workers and are represented in the estimate of direct in-port and off-port maritime service workers presented in Table 7 on page 45.

Dole Fresh Fruit Company, Inc. Dole Food is the world's largest producer of fresh fruit and vegetables. The company was founded in 1851 and taken private in late 2013. Dole grows, packs, processes, and distributes fruits in over 90 countries. Dole Fresh Fruit Company operates as a subsidiary of Dole Food Company, Inc.

Dole Fresh Fruit Company executed a long-term lease in March of 2015 with the Port of Gulfport to provide terminal space for up to 23 years. Dole is located in the new $47 million West Terminal Transit Shed at the Port of Gulfport. This facility includes 300,000 square feet of dry storage, a chilled storage, blast freezer and frozen storage capacity as well as office space.

Dole reported a total of 19 employees with an average annual wage of $63,000; employees receive a comprehensive benefit package to include health, dental, vision, 401K savings plans, and retirement benefits. In this study, all workers employed by Dole Fresh Fruit Company are considered to be maritime workers and represented in the estimate of direct in-port and off-port maritime service workers presented in Table 7 on page 45.

Chemours Company was created in 2015, after a separation from DuPont and became a new, independent, publicly traded company. The Chemours Company is an American chemical company with headquarters in Wilmington, Delaware with a market capitalization of $5.3 billion, annual revenue of approximately $6.18 billion, and gross profit of $1.8 billion in fiscal year 2017. Chemours is a leading

provider of performance chemicals in three segments: titanium technologies, fluoro-products, and chemical solutions. Chemours operates 35 production facilities in 11 countries and markets its products in more than 130 countries.

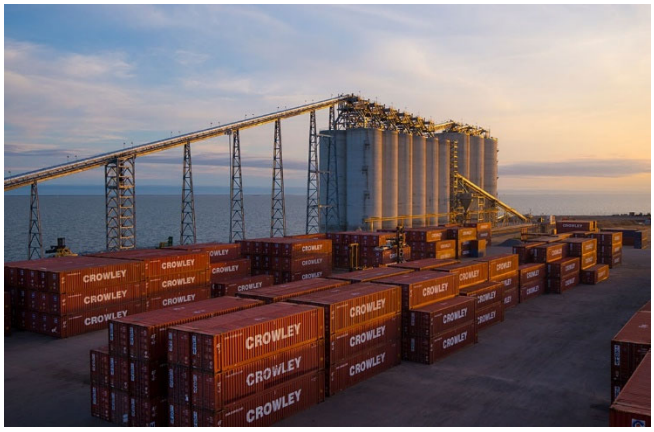


Image 4: Chemours Ore Handling Silos and Loading Facilities at the Port of Gulfport

The Chemours facility at the port is located at the immediate south end of the West Pier. The Chemours facility is an ilmenite ore handling facility that consists of: ship to storage receiving conveyor systems and vertical storage capacity (twelve silos 40' wide x 139' tall and three silos 65' wide x 159' tall) with a total capacity of approximately 220,000 tons that are used to store ilmenite ore and other raw materials. Initial design and planning activities began in 2013; the project was completed in the Fall of 2016. This project represented an $85 million public-private partnership investment between the Mississippi State Port Authority and Chemours; there is an agreement with Chemours to repay $62 million of the investment over a 10-year period and Chemours' 30-year lease agreement calls for annual lease payments and wharfage fees of $1.6 million. Construction of the Chemours facility included a Yates Anderson joint venture with Continental Construction Company, Inc.; an estimated 500 construction workers were employed during the construction of the facility.

Chemours uses ilmenite ore to produce titanium dioxide pigment which is used as a whitening agent in paints, papers, and plastics. Access to the silos at the Port of Gulfport to receive and store raw materials was a critical factor in the expansion of Chemours' operations in the area. In 2018, Chemours invested an additional $25 million in Harrison County to build a new 300,000 square-foot distribution center and production center in DeLisle; it is the largest titanium dioxide production facility in the world and employs approximately 1,200 people. The Chemours Company also employs approximately 180 people at its First Chemical plant in Pascagoula, Mississippi. These employment figures are not included in this study.

Chemours employs approximately 11 full-time equivalent workers at the Port of Gulfport terminal site; these workers are defined as maritime service workers and included in the estimate of direct in-port maritime service workers presented in Table 7 on page 45.

E.N. Bisso Mississippi, LLC d/b/a Gulfport Towing provides ship-assist services for docking ocean-going vessels and provides offshore towing services. E.N. Bisso is a family owned business, operated by descendants of the company's founder Captain Joseph Bisso. The company operates a fleet of 19 tugs and is predominantly engaged in harbor towing. E.N. Bisso employs 5 full-time and one part-time person to provide maritime services at the Port of Gulfport; these workers are included as direct maritime services employment in Table 7 on page 45.

Crowley Maritime Corporation is a U.S.-owned and operated provider of transportation and logistics services to domestic and international markets with annual revenues of approximately $2 billion and 5,300 employees. Founded in 1892 and headquartered in Jacksonville, Florida, the current Chairman and CEO of Crowley is the grandson of Thomas Crowley, the founder of the company. The company is privately owned by members of the Crowley family and by Crowley employees. The firm maintains a fleet of approximately 200 vessels that include lift-on-lift-off (Lo/Lo), Ro/Ro, tugs and barges. CrowleyFresh, a subsidiary of Crowley provides cold-chain storage and logistics; Crowley Marine Services has deep experience in marine operations, heavy-lift services, and offshore engineering and construction; and the company provides a broad range of supply chain services for the private and military sectors. Crowley's offshore services group provides ocean towing, offshore installation support, ship tows, and marine salvage support. The company is among the largest independent owner-operators of U.S. flag ship tanker vessels, providing bulk petroleum and chemical transport throughout the U.S. Gulf Coast and the East and West Coasts. Crowley's expansive capabilities and expertise in a range of air, ocean, and transportation services positions it to meet the growing demand for services at the port and to contribute to the future growth of the Port of Gulfport. Located on the West Pier at the Port of Gulfport, Crowley provides port terminal services and scheduled liner services to and from Central America to include the countries of Guatemala, Honduras, El Salvador, and Nicaragua. Crowley's operations at the Port of Gulfport encompass a terminal area of 15 acres with 15,000 square feet of warehouse space and yard capacity for 560 trailers and one Ro/Ro berth; from these facilities it serves Central America, the Dominican Republic, and Panama. In addition to warehousing and inland transportation services, Crowley also offers vessel maintenance and repair services, customs and USDA-APHIS inspection services, and reefer hookups for refrigerated containers at the Port of Gulfport. Crowley also operates a warehouse and distribution center at 4300 Air Cargo Road in Gulfport.

Crowley employs three FTE workers at its facility on the West Pier at the Port of Gulfport; they contract with stevedoring companies such as Ports America and SSA Marine to provide services and to subcontract for ILA Longshoremen to load and unload cargo and to provide other maritime services. Employment at Crowley is included in the calculation for direct in-port maritime services full-time equivalent workers found in Table 7 page 45.

Maritime Industry Manufacturers, Shipbuilders, and Fabricators

McDermott International is a global onshore and offshore construction, engineering, and fabricating company. It operates a fleet of marine construction vessels to include derrick barges, construction and pipelay, and support vessels that transport and install complex structures in shallow and deep-water environments. In 2014, the company executed a 10-year tenant lease with the option for three additional 10-year extensions with the Port of Gulfport. McDermott operates high-performance, specialized offshore service vessels that primarily serve the oil and gas recovery industry. It uses its facility at Port of Gulfport as its' spool-base operations to meet the demand for deep-water and ultra-deep-water rigid pipeline installation. The McDermott facility consists of 50 paved acres on the East Pier that include a pipe receipt and storage area, fabrication building, storage warehouse, a 3,000 foot stalk rack with the capacity to hold approximately 9,500 tons of pipe, and dedicated quayside to accommodate the specialized needs of McDermott's fleet of vessels used for offshore transportation

Image 5: McDermott International at the Port of Gulfport – spooling vessels used to lay underwater pipeline

and installation. There is an average of approximately 136 full-time equivalent workers over a 12-month period employed at the McDermott facility at the Port of Gulfport. Although McDermott could technically be classified as a maritime services provider because they provide offshore "services," the Stennis Research Team determined that the predominant function of most workers employed by McDermott at its Port of Gulfport facility is to manufacture, fabricate, and store wire. Therefore, these workers are classified as manufacturing and fabrication workers and are *not* included in the estimate of direct in-port and off-port maritime *service* workers presented in Table 7 on page 45; the direct, indirect, and induced effects of employment at McDermott International are presented in Table 13 page 47.

The Inland Port

The Inland Port Facility is a 116-acre site that provides manufacturing space, rail access, barge connections and easy access to the deep-water port; the site was purchased by the Mississippi State Port Authority for $32 million to expand the footprint of the port and to increase the capacity of the port to meet the needs of maritime service providers and manufacturers. The Gulf Coast Shipyard Group and Topship occupy facilities at the Inland Port.

The Gulf Coast Shipyard Group, Inc.

(GCSG) became a tenant of the Port of Gulfport in January of 2014. The Gulf Coast Shipyard Group manufactures offshore support (OSVs) and multi-purpose supply (MPSVs) vessels for the U.S. and global market. GCSG and its' affiliate, Harvey Gulf International Marine, design and construct commercial and military offshore vessels, oil field support vessels, offshore and inland

Image 6: Aerial Image of Gulf Coast Shipyard Group Facility - Gulfport

barges, patrol craft and security vessels, and oil spill response vessels; these vessels range from 32 feet to 410 feet in length. The company also manufactures superyachts under the *Trinity Yachts* brand name. Gulf Coast Shipyard Group and its affiliate, Harvey Gulf International Marine, are major suppliers in the offshore support vessel (OSV) and multi-purpose supply vessel (MPSV) industry.

The offshore support vessel (OSV) and multi-purpose supply vessel (MPSV) industry is differentiated into multiple segments based upon vessel type (e.g. platform supply vessel, multipurpose support vessel, anchor handling tug supply, crew vessel), depth (e.g. shallow-water, deep-water, or ultra-deep-water), and by end-user. Offshore oil and gas exploration and production requires an array of specialized vessels and barges. OSV and MPSV vessels used in the offshore industry include survey and supply vessels during the survey and exploration stages; platform supply vessels, heavy lift barges, and accommodation work barges during the construction stages; stimulation vessels to conduct well stimulation; and diving support vessels to provide subsea support services. A range of emergency response vessels, e.g. firefighting vessels, rescue vessels, safety standby boats, and oil spill recovery vessels, are also required by the offshore oil and gas industry; these vessels are also used by the military and by federal or state agencies. OSVs and MPSVs are either operated by the owners of the vessels or by companies that lease the vessels from owners. The OSV and MPSV industry is generically termed the "*workboat sector*."

Demand for vessels in the workboat sector is highly cyclical and correlated with macro-economic factors, particularly those that impact oil and gas exploration and production. The Great Recession and languishing oil prices impacted the demand for OSVs and MPSVs. The OSV market is beginning to recover from the impacts of the U.S. drilling moratorium of 2010, declining and stagnant oil and gas prices, decreases in offshore rig counts, and increased oil and gas supply from onshore sources (e.g. shale formations). Increased competition for declining demand led operators to reduce charter rates below break-even costs. Many operators in the OSV industry were forced into bankruptcy after years of operating at a loss and the industry experienced consolidation; there were also significant shifts in the market share held by boat owners. One example is provided by operators of the largest platform supply vessels (PSVs that are ≥ 3,000 dwt) in the U.S. Gulf Coast. In this segment, Edison Chouest's market share declined from approximately 52 percent to 39 percent over the period from January 2014 to June 2018, while Harvey Gulf International's market share increased from 12 percent to 16 percent over the same period.[14]

More recently, the workboat market and manufacturers within the industry are adapting to numerous changes within the environment that are reinvigorating demand, these include:

- the United States lifting a 40-year ban on crude oil exports in 2015;
- a 6 percent increase of capital expenditure by the oil and gas industry associated with infrastructure investments in offshore activities during 2018;
- shifting trends towards deep-water versus shallow-water exploration and production are creating an imbalance between the supply and demand for deep-water vessels versus shallow-water vessels;

[14] Offshore Magazine. https://www.offshore-mag.com/vessels/us-gulf-of-mexico.html, accessed April 20, 2019.

- design and technological improvements in the industry have enabled the manufacture of OSVs and MPSVs with increased flexibility to perform a range of activities, including the capability to perform heavy lifts, well interventions, cable lay, pipelay, subsea installation, and other services;
- increased demand for LNG bunkering vessels as ship operators switch from heavy bunker fuel to liquefied natural gas (LNG) because of stricter sulfur emission standards. The Gulf Coast Shipyard Group and its affiliate, Harvey Gulf International, are key participants in the industry transition to LNG powered vessels. Beginning in 2014, Harvey Gulf invested $25 million to construct the first LNG bunkering facility in the United States and has committed an investment of up to $350 million in the construction of dual-fuel OSVs to be operated in the Gulf of Mexico; the first of six of these new vessels was constructed and launched at Gulf Coast Shipyard (see Image 7 on page 38). Harvey Gulf and its subsidiary Gulf Coast Shipyards seek to become leaders in the utilization of LNG as a marine fuel; these investments are designed to support that objective.

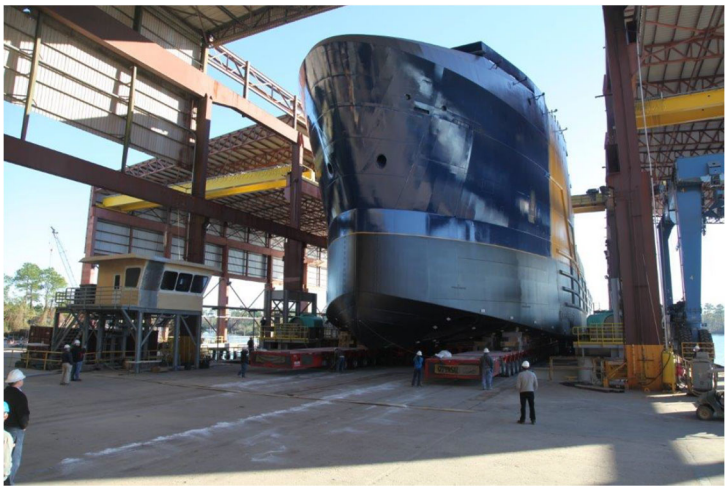


Image 7: January 2014 Launch of LNG OSV from GCSG facility

According to the "*Global Offshore Support Vessel Market 2019 — 2023*" report[15] the global offshore support vessel market generated revenue of approximately $19.02 billion in 2017; the OSV market is expected to grow at a compound annual growth rate of 5.02 percent to $26.8 billion over the period from 2018 to 2024.[16]

Reported employment at the Gulf Coast Shipyard Group averaged 116 full-time equivalent workers over a 12-month period since the company became a tenant at the Inland Port at Gulfport. Due to the highly cyclical demand for workers at GCSG, most of these workers are contract workers employed to meet specific demand. Workers at Gulf Coast Shipyard are defined as maritime industry *manufacturing* workers. Employment for GCSG is not included in the estimate of direct in-port and off-port maritime *service* workers presented in Table 7 on page 45; it is reported separately in Table 12 on page 47.

[15] Research and Markets. "*Offshore Support Vessel Global Market Report 2018-2023 - Aging of Offshore Infrastructure Leading to Replacement and Decommissions*." Business Wire (English), 2018 May 4AD. EBSCOhost, search.ebscohost.com/login.aspx?direct=true&db=bwh&AN=bizwire.c83970733&login.asp?custid=magn1307&site=eds-live&scope=site. Accessed April 20, 2019.
[16] Ibid.

Topship, LLC., is a shipbuilding company that is a subsidiary of Louisiana based Edison Chouest Offshore (ECO). Similar to Gulf Coast Shipyards, Edison Chouest and Topship are major service suppliers to the offshore industry. ECO operates a fleet of over 200 offshore service vessels (OSVs) and multi-purpose service vessels (MPSVs) that serve a global customer base. Edison Chouest's competitive advantage is derived from the ability to design and build high-capacity and technologically advanced vessels in its shipbuilding subsidiaries (e.g. Topship). In addition to the manufacture and maintenance of vessels, ECO provides vessel services, multi-service terminal facilities, and logistics services to coordinate, expedite, and track cargo movement. Topship operates in the same industry segment as Gulf Coast Shipyard Group; both companies are operating in a challenging market environment. In February 2016, ECO announced that it would be making an investment of $68 million to locate at the former Huntington Ingalls Composite Facility at the Inland port on Seaway Road; as part of that agreement, the Mississippi Legislature agreed to provide up to $10 million in discretionary grants and one million dollars for workforce training to support the project. Incentives provided to the project were based upon the assumption that 1,000 full-time jobs would be created at Topship's facility at the Inland Port. Topship failed to meet its job creation objectives and the state statute that authorized the incentives expired on December 31, 2018, for this reason no employ impact associated with Topship is included in this report. Pursuant to its agreement, Topship made an initial payment of $16 million and continues to make a monthly lease payment of $85,000 plus interest; but receives no incentive grants or workforce investment funds from state funds. Topship remains as a tenant at the port and continues to meet its payment obligations.

Image 8: Edison Chouest 318.67' MPSV C-INSTALLER

The Merchant Marine Act of 1920

The Merchant Marine Act regulates maritime commerce in U.S. waters and between U.S. ports; Section 27 of the statute is called "The Jones Act." The Jones Act deals with coastal trade (cabotage); it requires that all goods transported by water between U.S. ports be carried on vessels that are built in the United States, owned by U.S. citizens, and documented ("flagged") under the laws of the United States. If the U.S. owner of a Jones Act ship is a corporation, 75% of the corporation's stock must be owned by U.S. citizens. The Jones Act also requires that all officers and 75 percent of the crew be citizens of the United States. Vessels that meet these requirements comprise the "Jones Act Fleet." The Jones Act also defines specific rights for seamen, including the ability to receive compensation for injury. The Jones Act applies only to domestic waterborne shipments. It does not apply to the nation's international waterborne trade, which is transported almost entirely by foreign-flag ships.

The Merchant Marine Act contains multiple statements of U.S. maritime policy, these include:

- "That it is necessary for the national defense and for the proper growth of its foreign and domestic commerce that the United States shall have a merchant marine of the best equipped

and most suitable types of vessels sufficient to carry the greater portion of its commerce and serve as a naval or military auxiliary in times of war or national emergency, ultimately to be owned and operated privately by citizens of the United States; and it is hereby declared to be the policy of the United States to do whatever may be necessary to develop and encourage the maintenance of such a merchant marine."

- "the preservation of the U.S. shipyard industrial and manufacturing base with the skills to build and repair vessels"

Congress has not defined what constitutes a U.S.-built vessel; it has designated the U.S. Coast Guard as the responsible entity for enforcing the U.S.-build requirement for vessels. Shipyards usually request confirmation from the Coast Guard that the use of certain foreign-built components in vessel construction will not disqualify the vessel from Jones Act trade. The Coast Guard issues "determination letters" to provide details regarding the permissibility of the use of foreign components. The Coast Guard provides endorsements for "Jones Act-qualified" vessels that meet the build, ownership, and crew requirements of the Jones Act. Customs and Border Protection (CBP) is primarily responsible for determining what maritime activity falls under the Jones Act and defines what constitutes "transportation" and whether the origin and destination of a voyage are "U.S. points."

Congress has enacted multiple exemptions or exceptions to the Jones Act, particularly when there are findings that no Jones Act-qualified operators are able to provide services to a specific market or when there are findings that a waiver would bring no harm to the U.S. domestic maritime industry. For example, in 1996 and in 2011, Congress permitted foreign-flagged liquefied natural gas (LNG) tankers to provide domestic service because no LNG tankers existed in the Jones Act fleet. In 1996, when there were not enough Jones Act-qualified vessels available, Congress enacted exemptions for vessels to participate in oil spill cleanup activities. Crowley Maritime mobilized 18 company owned and/or operated Jones Act petroleum vessels to respond to fuel shortage in Florida during Hurricane Irma in 2017; it delivered 15 million gallons of gasoline and 21 million gallons of diesel fuel within an eight-day period to ports in Jacksonville, Port Canaveral, Fort Lauderdale, and Tampa. After Hurricane Maria in 2017, the U.S. Department of Homeland Security waived the Jones Act to allow foreign-flagged ships to deliver supplies and assistance to Puerto Rico while U.S.-flagged ship owners and operators argued that there was more than sufficient capacity to adequately respond to the disaster. Many reports indicate that a major cause of the delay in providing relief to Puerto Rico was port congestion, inadequate dock space and delays in off-loading and distributing relief supplies inland by surface transportation while vessels with thousands of containers waited offshore to dock. During the response to Maria, Crowley Maritime's Jones Act-qualified container ships provided well over 2,200 container loads of commercials goods, food and aid cargo.

With the advent of the significant expansion of the use of container ships, Congress exempted the movement of empty containers between U.S. ports from the Jones Act; this allowed foreign-flagged container ships to reposition empty containers throughout U.S. ports. This exemption did not extend to the transshipment of loaded containers by feeder ships. The Jones Act requires that the transshipment of loaded containers using smaller feeder container ships between U.S. ports be conducted by Jones Act-qualified ships. Because there are few U.S. built, crewed, and owned small feeder container ships in

the fleet, Jones Act-qualified vessels play a relatively small role in transshipping international containerized cargo between U.S. ports.

The Jones Act's statement of maritime policy indicates the need for a commercial domestic fleet that can provide sealift in times of war. Since the enactment of the Jones Act, three fleets have been created to support sealift activities: The Ready Reserve Force (RRF), the U.S. Navy's Military Sealift Command (MSC), and the Maritime Security Program (MSP). The RRF consists of approximately 51 vessels owned by the U.S. government, contracted to the private sector, and crewed by U.S. Mariners; these ships are preloaded with military equipment and strategically stationed throughout the world and are prepared to deploy within 4 to 20 days. The MSC provides ocean transportation and logistics to the U.S. military; it operates approximately 120 ships that provide fuel, cargo, ordnance, vehicles, and supplies to support global operations. The Maritime Security Program was established in the Maritime Security Act of 1996, it required the Secretary of Transportation, in consultation with the Secretary of Defense, to establish a "fleet of active, commercially viable, militarily useful, privately-owned vessels to meet the national defense and other security requirements." Currently there are approximately 60 MSP "U.S.-flagged" ships; these are vessels owned or operated by domestic and international companies that domicile part of their business operations under U.S. Department of Defense protocols and register their ships under the U.S. flag using MSP operating agreements. MSP ships are staffed by U.S. crews and subsidized by Congress, they predominantly carry military and food aid. In 2014, Congress directed the Departments of Transportation and Defense to develop a national sealift strategy. Recent reports from the U.S. military indicate significant problems with the sealift fleets with many vessels reaching or exceeding their hull life the military is examining the recapitalization of the country's sealift capacity and the replacement of auxiliary vessels. In September 2018, a report entitled "*Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States*" was issue by an Interagency Task Force consisting of the U.S. Departments of Defense, Commerce, Labor, Energy, and Homeland Security.[17] This report found that "industries involved in the manufacturing of shipbuilding components were among the hardest hit by the global shift in the industrial base over the last 20 years" and that "since 2000, these industries experienced a combined decline of over 20,500 establishments in the U.S." This report also found that "the shipbuilding industrial base is a national asset and absolutely vital to America." In February 2019, the U.S. Army sent a letter to Congress indicating that the country's sealift capacity would fall below the level required to move the Army's equipment by 2024 if action was not taken to recapitalize the Sealift Fleet. Increased capacity and growth of the U.S.-flagged merchant marine is a vital element to increasing the nation's sealift capabilities. Gulf Coast Shipyard Group with its parent company Harvey International and Topship with its parent company Edison Chouest are all builders and operators of Jones Act-qualified vessels. Crowley Maritime operates the largest U.S. -flagged petroleum and chemical tank vessel fleet with over 37 Jones Act-qualified large petroleum transportation vessels including tankers and articulated tug barges (ATB). Throughout the history of the United States, the Jones Act fleet has demonstrated its ability to provide the capacity and manpower required during U.S. military deployments and has guaranteed that a ready force of merchant seamen can be mobilized quickly in times of war. In more recent years, some

[17] https://media.defense.gov/2018/Oct/05/2002048904/-1/-1/1/ASSESSING-AND-STRENGTHENING-THE-MANUFACTURING-AND-DEFENSE-INDUSTRIAL-BASE-AND-SUPPLY-CHAIN-RESILIENCY.PDF. Accessed May 2019.

members of Congress have attempted to repeal or roll back the Jones Act, arguing that it is obsolete and protectionist; other members of Congress strongly support strengthening the provisions of the Jones Act and seek to provide expanded funding to modernize and expand the sealift capabilities of the Ready Reserve Force and the Maritime Security Program. Federal policy making related to the Jones Act has the potential to impact the future growth and level of economic activity at takes place at the Port of Gulfport.

V. Local Area Maritime Employment Impact of the Revitalization of the Port of Gulfport

The revitalization of the Port of Gulfport generated two levels of economic activity:

1. Economic impact associated with the construction phase of project activities. Construction activity and the economic impact of construction related spending creates short-term economic activity. The economic impact of the construction phase of the revitalization of the Port of Gulfport is beyond the scope of this study. As of December 2018, the Mississippi Development Authority reported that approximately 1,759 full-time equivalent jobs were supported during the construction phase of revitalization investments at the Port of Gulfport. The economic impact of construction related employment is not addressed in this study.
2. Economic impact associated with the ongoing operations of the Port of Gulfport upon completion of the construction phase of the project. These economic impacts are discussed in the following section of this study. Evaluation of the economic impact of the revitalization of the Port of Gulfport requires consideration of the changing environment within which all ports operate and the changing and evolving characteristics that are unique to the Port of Gulfport. Prior sections of this study have discussed the macro- and micro-economic factors that impact port operations to include changes in world trade, global and U.S. economic growth, increased ship size, industry consolidation, the exponential growth of containerization, and the diffusion of automation technologies; these factors have increased the pressure on ports to improve and upgrade their facilities. Ports are becoming increasingly complex, more capital intensive, require larger land footprints, and are becoming more efficient thereby reducing the labor intensity of port operations.

As gateways to continental distribution systems, ports support the import- and export-based activities that are linked to the productivity of local and regional economies to include commodity production, manufacturing and industrial activities; ports do not act in isolation from these local and regional economies. Port authorities play a significant role in supply chain management and are increasingly engaged in the development of strategies to improve the performance of regional industry clusters. From this perspective, ports confer national and regional economic and social benefits; having access to global and regional distribution systems conveys important economic advantages to regional and local economies. A port, through its connectivity to global markets, raw materials and parts, can maximize the economic landscape of a region. Ports are strategically critical transportation infrastructure that are important factors in economic development and growth. Ports expand market opportunities for local, state, regional, national, and international businesses in all sectors of the economy; but these benefits are predominantly conferred upon the hinterland that they serve. The economic benefits of ports are distributed across a wide geography that transcends the local community and the immediate area surrounding the port. These factors skew the assessment of the economic benefits of a port because local economic impacts may be less significant than the benefits that accrue at the regional or national level. The economic benefits of a port are most related to the supply chains they support and are less directly related to port activity. However, ports act as an important catalyst for local economic development because they influence growth in multiple economic sectors and stimulate business

formation and growth in locations that are in close proximity to the port and provide access to modal or intermodal infrastructure which generates high value – this is the clustering effect.

The economic benefits of a port are commonly categorized as direct, indirect, and induced effects and measured at the aggregate level by value added, fiscal impacts, and employment. The most commonly observed economic benefit of a port is on regional employment. In general, port throughput is related to employment within the port region. Employment impacts vary by commodity sector; container and breakbulk activities have approximately twice the impact of dry and liquid bulk throughput. Although the research findings vary widely, each direct port job is generally found to be associated with approximately 3 to 4 indirect jobs. It is important to note that with the advent of mechanization and containerization, in-port employment has declined accordingly; however, most port-related jobs pay a higher wage when compared to other economic sectors. Labor normally comes from the local/area economy and the multiplier benefits of direct labor wages also derive to the benefit of the local/area economy.

Employment Impacts

All employment impacts reported in this study are modeled using an RPC coefficient to constrain the impact to reflect only the employment impact within the three Mississippi counties of Harrison, Hancock, and Jackson. Employment impacts comprise three types of impact: direct, indirect, and induced.

Direct Employment Impact consists of job creation related to the movement of containers and freight; this includes jobs at marine terminals, stevedores, longshoremen, steamship agents, freight forwarders, employment at trucking companies, and railroads moving cargo between the port terminals and inland destinations and origins. Direct employment also includes jobs that are necessary to the ongoing operations, maintenance, and management of the port.

Indirect Employment Impact is defined as jobs that are created due to the purchases of goods and services by firms. Indirect job creation may include jobs that are created at local equipment suppliers, maintenance and repair firms, local office supply firms, and business insurance providers

Induced Employment Impact includes job creation in the local economy associated with the spending of direct employment wages and salaries. Individuals whose jobs are directly employed spend their wages and salaries on goods and services on the purchase of housing, clothing, food, and other items. This spending supports jobs at local businesses such as grocery and retail stores, restaurants, the offices of physicians and other healthcare providers, and other goods and service providers.

Direct In-Port and Off-Port Maritime Services Employment

Container volumes generate employment in four ways: 1) direct container handling in-port; 2) warehousing, distribution, and truck drayage of containers off-port; 3) off-port services to include freight forwarders and ship services; and 4) container transport by rail. Based upon industry standards and multiple previous studies (e.g., the U.S. Army Corps of Engineers, Parsons Brinkerhoff), full-time equivalent (FTE) employment can be estimated for the first three categories of impact. For a conventional terminal, the labor needs for in-port activity, e.g. stevedoring, material and containing handling, is 1.25 FTE employees per 1,000 TEUs. Warehousing and distribution, to include truck drayage would require 2.65 employees per 1,000 TEUs; other off-port activities (excluding container transport

associated with rail shipment) would require 0.858 employees per 1,000 TEUs. The sum of these activities indicates that total employment needs for a port are 4.758 employees per 1,000 TEUs. This would include direct on-port activity, employment associated with warehousing and distribution, and other off-port activities. Based upon these assumptions and the 2018 TEU data from the Port of Gulfport, total labor requirements are summarized as follows:

Table 7: Direct In-Port and Off-Port Services Employment and Annual Employee Compensation for The Port of Gulfport

Direct Impact based upon 206,196 TEUs	Model Assumption Labor Needs Per 1,000 TEU	Annual Labor Requirements	Annual Compensation per Employee	Total Industry Employee Compensation
In-Port Activity	1.25	257.7	$74,537	$19,211,539
Warehousing and Distribution	2.65	546.4	$45,011	$24,594,884
Other Off-Port Support Activities	0.858	176.9	$35,139	$6,216,657
Total	**4.758**	**981.1**	N/A	$50,023,080

Source: Stennis Institute of Government Analysis based on IMPLAN and per TEU factors
Annual compensation sourced from Department of Labor Statistics for the State of Mississippi

Table 7 above includes the direct maritime services employment impacts of the port including support service employment generated from trucking drayage, warehousing and distribution, and other container services that occur off-port. These estimates are for labor only, they do not include the purchase of materials, supplies, and other services by the Port Authority or by businesses providing warehousing and distribution, and truck drayage. Full-time equivalent employment associated with in-port activity, as shown in Table 7 above, includes workers from the International Longshoremen's Association, and employees at the following companies: Dole, Chiquita, Swetman Security, E.N. Bisso, Crowley Maritime, the stevedoring firms of SSA and Ports America, employees at the Mississippi State Port Authority who provide services directly related to the movement of cargo into and out of the port, and employees of Chemours who have responsibility for oversight of the transshipment bulk cargo,

To determine the multiplier effect of direct in-port and off-port services employment related to the maritime activities at the Port of Gulfport, an econometric input-output model was used to calculate the impact of these activities within the local area. The model was constrained to restrict multiplier effects within the three-county area of Harrison, Hancock, and Jackson counties using an RPC coefficient; these results are presented in Table 8 below. As shown in Table 8 below, when the model is constrained to the three-county area, total direct employment declines from 981.1 (Table 7 above) to 903.6; this difference (77.5 FTE workers) reflects employment effects outside of the three county area. The average annual income associated with direct Maritime Services employment is approximately $37,916; this compares to median earnings of $31,781[18] for full-time, year-round workers in Gulfport, Mississippi.

Table 8: Maritime Services Employment Effects of the Port of Gulfport based upon 2018 TEU Throughput

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	903.6	$34,261,731	$54,618,475	$207,840,703
Indirect Effect	635.7	$30,843,818	$50,086,545	$90,956,798
Induced Effect	306.6	$10,001,576	$20,724,293	$36,173,762
Total Effect	**1,846.0**	**$75,107,126**	**$125,429,313**	**$334,971,263**

Source: IMPLAN

[18] U.S, Census Bureau, 2013 – 2017 American Community Survey 5-Year Estimates.

The total fiscal (tax) effect of on-port and off-port maritime services employment impacts related to the Port of Gulfport are estimated to be $8,935,046 annually (Table 9 below):

Table 9: Fiscal Impacts of the Port of Gulfport based upon 2018 Throughput and On-going Business Activity

Sales Tax	Property Tax	Motor Vehicle Licenses	Severance Tax	Other Taxes
$4,484,297	$2,505,363	$47,056	$32,094	$482,252
Personal Tax: Income Tax	**Personal Tax: NonTaxes (Fines-Fees)**	**Personal Tax: Motor Vehicle License**	**Personal Tax: Property Taxes**	**Personal Tax: Other Tax (Fish/Hunt)**
$881,680	$414,490	$53,111	$27,941	$6,762
Source: IMPLAN				

Indirect and Induced Effects of Non-Wage Warehousing and Distribution Spending for Materials, Supplies, and Contract Services

On-Port and Off-port direct employment impacts are presented in Table 7 and Table 8 on page 45; these estimates are for labor only, and do not include business expenditures for the purchase of materials, services, or supplies by providers of warehouse, distribution, and transportation services. According to the American Transportation Research Institute,[19] the ratio of truck drivers' wages and benefits is approximately 0.59 to other costs; this indicates that other costs associated with the ongoing business operations of warehouse and transportation services providers is approximately 1.7 times the costs of industry wages and benefits. Based upon this assumption, the change in final demand associated with expenditures by businesses providing on-port and off-port transportation, warehousing, and trucking services is estimated to be $41,811,302. To continue the analysis of local economic impact, spending associated with the provision of warehousing, distribution, and transportation services was used to estimate non-wage spending. Econometric input-output multipliers were then applied to estimate the additional indirect and induced effect of direct on-port and off-port economic activity. The model was run using an RPC coefficient specific to Harrison, Hancock, and Jackson counties in Mississippi to limit direct, indirect, and induced economic effects to the local area; the results of this analysis are shown in Table 10 below.

Table 10: Induced and Indirect Effects of Non-Wage Spending for Materials, Supplies, and Contract Services

Impact Type	Employment	Labor Income	Value Added	Output
Indirect Effect	251.6	$8,761,680	$12,915,781	$33,227,327
Induced Effect	41.1	$1,341,102	$2,778,826	$4,850,557
Total Effect	292.7	$10,102,782	$15,694,607	$38,077,884

Source: IMPLAN

[19] American Transportation Research Institute, An Analysis of the Operational Costs of Trucking: 2017 Update. http://atri-online.org/wp-content/uploads/2017/10/ATRI-Operational-Costs-of-Trucking-2017-10-2017.pdf accessed December 29, 2018.

The total fiscal impact of the indirect and induced impacts of business expenditures related to ongoing business operations excluding direct employment related spending was estimated to be $1,023,769 (Table 11 below).

Table 11: Fiscal Impacts of Indirect and Induced Economic Effects of Non-Wage Related Business Expenditures

Sales Tax	Property Tax	Motor Vehicle Licenses	Severance Tax	Other Taxes
$497,966	$278,212	$5,225	$3,564	$53,552
Personal Tax: Income Tax	**Personal Tax: NonTaxes (Fines-Fees)**	**Personal Tax: Motor Vehicle License**	**Personal Tax: Property Taxes**	**Personal Tax: Other Tax (Fish/Hunt)**
$118,015	$55,481	$7,109	$3,740	$905

Source: IMPLAN

The Impact of Maritime Manufacturing and Fabrication Employment at the Port of Gulfport

The two primary employers included in the employment impact of the revitalization of the Port of Gulfport are Gulf Coast Shipyard and McDermott International. As discussed in prior sections of this study, Gulf Coast Shipyard is a tenant at the Inland Port and McDermott occupies approximately 50 acres at the West Pier.

The econometric input-output model for employment at Gulf Coast Shipyard and for McDermott International was constrained to reflect only the impact of employment within Harrison, Hancock, and Jackson counties using an RPC coefficient.

Table 12: Maritime Industry Employment Effects Associated with Gulf Coast Shipyard Group

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	92	$7,832,084	$9,699,933	$28,785,128
Indirect Effect	30.7	$1,274,021	$2,037,334	$4,019,218
Induced Effect	41.1	$1,324,205	$2,816,958	$5,078,470
Total Effect	**163.8**	**$10,430,310**	**$14,554,225**	**$37,882,816**

Source: IMPLAN

Assumption: Based upon reported average of 116 FTE over 12-month period from 2014 to 2018

Table 13: Maritime Industry Employment Effects Associated with McDermott International

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	126.0	$2,983,371	$3,398,940	$9,613,329
Indirect Effect	18.7	$801,436	$1,352,624	$2,779,227
Induced Effect	17.3	$556,470	$1,183,995	$2,133,675
Total Effect	**162.0**	**$4,341,276**	**$5,935,560**	**$14,526,231**

Source: IMPLAN

Assumption: Based upon reported average of 135 FTE over a 12-month period 2014 to 2018

Summary of Maritime Employment Impacts and Related Economic Output

A summary of the total annual impact of maritime activities at the Port of Gulfport is provided in Tables 14 through 16 below. Maritime services activities supported 903.6 FTE jobs and maritime industry tenants engaged in manufacturing and fabricating activities provided a total of 218 FTE jobs within Harrison, Hancock, and Jackson counties; direct full-time equivalent employment in the maritime services sector and the maritime manufacturing/fabrication sectors totaled 1,121.6 jobs (Table 14 below). The total full-time equivalent employment (direct, indirect, and induced) effect of maritime services and maritime industry manufacturing and fabrication activities occurring at the Port of Gulfport was 2,464.5 (Table 14 below). Labor income associated with total full-time equivalent employment averages approximately $99,981,494 annually (Table 15 below) across all types of employment (direct, indirect, and induced); the average annual income associated with these jobs is approximately $40,568. This compares to median earnings of $31,781[20] for full-time, year-round workers in Gulfport, Mississippi. According to Massachusetts Institute of Technology's Living Wage Calculator,[21] the living hourly wage for a family with two adults (with only one adult working) is $18.34 per hour or a required annual income before taxes of $38,144; the living wage model is considered to be a superior measure for determining the employment earnings that are necessary to meet a family's basic needs and the ability to maintain economic self-sufficiency.

Table 14: Total Maritime Employment Impacts of the Port of Gulfport

Impact Types	Maritime Service Employment	Corollary Employment Effects Warehousing/ Distribution/ Transportation	Tenant Manufacturing/Fabrication Employment Effects Maritime Industry		Totals
			Gulf Coast Shipyard	McDermott	
Direct	903.6	N/A	92.0	126.0	1,121.6
Indirect	635.7	251.6	30.7	18.7	936.7
Induced	306.6	41.1	41.1	17.3	406.1
Total	**1,846.0**	**292.7**	**163.8**	**162.0**	**2,464.5**

Source: IMPLAN

Table 15: Labor Income Effects of Maritime Employment Related to the Port of Gulfport

Impact Types	Maritime Service Employment	Corollary Employment Effects Warehousing/ Distribution/ Transportation	Tenant Manufacturing/Fabrication Employment Effects Maritime Industry		Totals
			Gulf Coast Shipyard	McDermott	
Direct	$34,261,731	N/A	$7,832,084	$2,983,371	$45,077,186
Indirect	$30,843,818	$8,761,680	$1,274,021	$801,436	$41,680,955
Induced	$10,001,576	$1,341,102	$1,324,205	$556,470	$13,223,353
Total	**$75,107,126**	**$10,102,782**	**$10,430,310**	**$4,341,276**	**$99,981,494**
Source:	*Table 8, page 45*	*Table 10, page 46*	*Table 12, page 47*	*Table 13, page 47*	

[20] U.S, Census Bureau, 2013 – 2017 American Community Survey 5-Year Estimates.
[21] http://livingwage.mit.edu/counties/28047. Accessed May 2019.

The movement of cargo through the Port of Gulfport and the business operations of maritime industry manufacturers and fabricators at the port generate revenues throughout the local economy. For example, revenue is received by the firms in the maritime service sector from arranging transportation services, cargo handling, and providing services and repairs to vessels that call at the Port of Gulfport. The Mississippi State Port Authority receives revenue for terminal and equipment leases as to shippers and consignees from the sales of cargo shipped through the port. Tenants receive revenue from the sales of products manufactured and fabricated at the Port of Gulfport. Revenue generated by port activity is used to pay employees' salaries and to hire longshoremen, and to purchase equipment, maintenance services, and other goods or services. The value of output created by the users of the port is modeled using output coefficients for user industries developed by the U.S. Bureau of Economic Analysis, Regional Input-Output Modeling System (RIMS II); the Stennis Institute Research Team restricted the econometric input-out model using regional purchase coefficients for the area encompassing Harrison, Hancock, and Jackson County. Annual economic output associated with the maritime industry activities at the Port of Gulfport are estimated to be $425,458,194 (Table 16 below).

Table 16: Economic Output Related to the Maritime Employment Effects of the Port of Gulfport

Impact Types	Maritime Service Employment	Corollary Employment Effects Warehousing/ Distribution/ Transportation (non-payroll business expenditures)**	Tenant Manufacturing/Fabrication Employment Effects Maritime Industry		Totals
			Gulf Coast Shipyard	McDermott	
Direct	$207,840,703	N/A	$28,785,128	$9,613,329	$246,239,160
Indirect	$90,956,798	$33,227,327	$4,019,218	$2,779,227	$130,982,570
Induced	$36,173,762	$4,850,557	$5,078,470	$2,133,675	$48,236,464
Total	**$334,971,263**	**$38,077,884**	**$37,882,816**	**$14,526,231**	**$425,458,194**

Source: IMPLAN

** this is business operating expenditure impact

Other Employment at the Port of Gulfport

Non-maritime employment at the Port of Gulfport consists primarily of employment at the Island View Hotel and Casino. The hotel industry is an important economic development tool and is an important job creator because it is labor intensive and has a significant multiplier effect on employment in other related sectors. Hotels and related businesses make a significant contribution to economic development and have been found to make an important contribution to the reduction of poverty.[22] Although jobs in the industry tend to have lower incomes and require lower skill levels when compared to other industry sectors, jobs in the hotel industry represent an opportunity for those with lower educational attainment; these jobs are stepping-stones to enhanced employment opportunities for low-skill workers. Women and youth are strongly represented in the industry. Research has found that, worldwide, women account for between 60 to 70 percent of the hotel industry labor force and that approximately 50 percent of the workforce is comprised of youth ages 25 or younger.[23] Based upon Island View's records, 1,167 full-time equivalent jobs were created between the 3rd quarter of 2013 and the 3rd quarter of 2018. The median hourly wage for workers at casino hotels is $14.00 per hour and the mean annual wage is $33,790 according to the Department of Labor Statistics' May 2018 National Industry-Specific Occupational Employment and Wage Estimates.[24] Employment at the Island View has not been included in this study.

At the time of the completion of this study, the University of Southern Mississippi's School of Ocean Science and Engineering was in the process of staffing a newly completed 18,000 square-foot Marine Research Center located at the Port of Gulfport. Employment at the Marine Research Center has not been included in this study.

[22] World Tourism Organization and International Labour Organization (2014). *Measuring Employment in the Hotel and Tourism Industries*, UNWTO, Madrid.
[23] Ibid.
[24] https://www.bls.gov/oes/current/naics5_721120.htm. Accessed February 2019.

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